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ABSTRACT

To study the teaching-learning process in classrooms, a small sample of carefully selected teachers at the second- and fifth-grade levels were identified for one phase of the Beginning Teacher Evaluation Study. A unique characteristic of this sample was that it included twenty teachers identified as relatively more effective in influencing achievement gains in their classes and twenty teachers identified as relatively less effective in their ability to teach certain objectives. Procedures and data related to the identification of these two disparate groups of teachers from a larger sample are described in this report. The teachers in the larger sample taught two-week, experimental units in reading and mathematics, and students completed pre- and post-tests. The smaller sample was selected based on information obtained from the student tests and classroom observation. (Authors)

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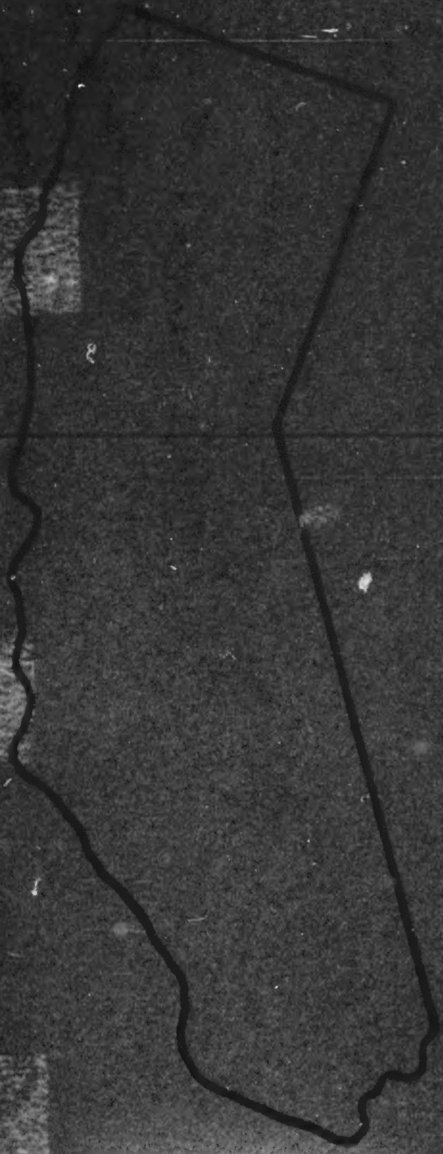

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BEGINNING TEACHER EVALUATION STUDY

Technical Report Series

TECHNICAL REPORT 76-12-1

EXPERIMENTAL TEACHING UNITS AND THE IDENTIFICATION OF A SPECIAL SAMPLE OF CLASSROOMS FOR CONDUCTING RESEARCH ON TEACHING

David C. Berliner
Nikola N. Filby
Richard S. Marliave
Jeffrey E. Moore
William J. Tikunoff
December 15, 1976

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ABSTRACT

To study the teaching-learning process in classrooms, a small sample of carefully selected teachers at the second and fifth grades were identified. A unique characteristic of this sample was that it included twenty teachers identified as relatively more effective in influencing achievement gains in their classes and twenty teachers identified as relatively less effective in their ability to teach certain objectives. Procedures and data related to the identification of these two disparate groups of teachers are described in this report.

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I. INTRODUCTION

One goal of Phase III-A of the Beginning Teacher Evaluation Study was to generate hypotheses about which teacher behaviors to study when conducting classroom-based research on teaching. Some clues about important variables come from the extant literature (e.g., Rosenshine, 1971; Duncan and Biddle, 1974). Some additional knowledge about the importance of particular variables comes from other phases of the research conducted for the California Commission for Teacher Preparation and Licensing (e.g., McDonald and Elias, 1976). However, even with these scources, determining which variables have the potential to affect student achievement is not an easy task.

The Laboratory approach to this task required the identification of a small sample of teachers that were known to be more or less effective in their ability to facilitate student achievement. If teachers vary markedly in their ability to affect student achievement, then any differences between teachers in teaching behavior and instructional technique are potential explanations for the difference in achievement. Intensive study of extreme groups should provide plausible hypotheses about which variables affect student achievement. The intensive study of such classes was completed and resulted in three reports:

Tikunoff, W. J., Berliner, D. C., and Rist, R. C. Special Study A: An ethnographic study of the forty classrooms of the Beginning Teacher Evaluation Study Known Sample. San Francisco, California: Technical Report 75-10-5, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, 1975. (129 pages plus appendices)

This report describes variables which differentiate the classrooms of more and less effective teachers. Teacher effectiveness was defined as the ability of second and fifth grade teachers to teach specially constructed reading and mathematics curriculum units over two weeks. Twenty more effective and twenty less effective teachers were visited for five days by specially trained ethnographers. Protocols of reading and mathematics instruction were prepared by the ethnographers. These protocols were rated and variables that distinguished between teachers of differential effectiveness were identified. Twenty-one of these variables were found to distinguish between the more and less effective teachers in their teaching of second grade reading, second grade mathematics, fifth grade reading and fifth grade mathematics. An additional 40 variables also showed some ability to differentiate between more and less effective teachers, but did not generalize across grade levels or subject matter areas. The use of a known sample of teachers varying in effectiveness, and the ethnographic procedures, were both methods found to be very useful in the study of classroom teaching.

Morine, G., and Vallance, E. Special Study B: A study of teacher and pupil perceptions of classroom interaction. San Francisco, California: Technical Report 75-11-6, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, 1975. (150 pages plus appendices)

Teachers were designated as more and less effective according to their ability to teach specially constructed reading and mathematics curriculum units over two weeks. They were then studied to determine if their perceptions of classroom interaction and interactive decision-making were different. They were also studied to determine whether they notice different aspects of teaching when viewing instruction by another teacher. In addition, pupils were also studied to determine what aspects of instruction were salient to them. Four variables related to the teachers thinking about instruction were found worthy of further study. These were in teachers' (a) logical/critical thinking, (b) comparative thinking, (c) negative thinking, and (d) amount of input accepted or sought during interactive decision-making. In addition, the examination of teacher and pupil perceptions of instruction also yielded variables worthy of further study. In particular, teachers with high pupil gain scores tended to emphasize cognitive aspects of the lesson more, while teachers with low pupil gain scores gave slightly more attention to affective aspects of the lesson. Furthermore, the most salient instructional characteristics for students were cognitive events, not affective events.

Morine, G., and Vallance, E. Special Study C: A study of teacher planning. San Francisco, California: Technical Report 76-3-1, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, 1976. (150 pages plus appendices)

Twenty more and twenty less effective teachers were studied to determine if they differed in the ways they plan for instruction. The effectiveness of the teachers was determined by their ability to affect gains in reading and mathematics over two weeks of instruction with a specially designed curriculum unit. Four variables were noted as distinguishing between the planning of the

> more and less effective teachers. These were: (a) whether the teacher used specific or general information in planning; (b) whether the teacher believed students had the potential to learn the material; (c) whether the teacher considered the cognitive aspects of instruction; and (d) whether the teacher produced much of his/her own instructional materials.

This report describes the "known sample" of teachers used in the studies cited above. In addition, this report describes the curriculum materials, known as Experimental Teaching Units (ETUs), that were used to help select the known sample of teachers that was intensively studied. Described on the following pages are the development of the ETUs; the recruitment of the initial sample of teachers; the data collection procedures used with this initial sample; the data analyses that resulted in the selection of the known sample from the initial sample; and a validity study of the procedures used to select the known sample. The conclusion of this report evaluates these techniques for their usefulness in the study of teaching.

II. DEVELOPMENT OF THE EXPERIMENTAL TEACHING UNITS

In order to select teachers with known ability to foster learning, it was considered important to be able to compare teachers' performances in a controlled situation. Most of the existing data on class achievement involve a variety of achievement measures administered at different times to students who have been required to cover different curricula. In order to provide a common basis for assessing a teacher's effectiveness, four Experimental Teaching Units (ETUs) were constructed. Each ETU was, in effect, a two-week curriculum unit, one in reading and one in mathematics. Separate units were developed for greades two and five. Each ETU controlled the domain of objectives to be taught and the amount of time to be spent in instruction. But teachers were left free to teach the ETU in any manner they chose, thus preserving the natural variability of teaching behaviors. An effort was made to provide a variety of materials and objectives from which the teacher could select, adapt, sequence, and organize an instructional program to meet the needs of the students, fitting the ETU within the normal patterns of organization and procedures in that classroom.

Each ETU is comprised of these components:

a. An introduction for the teacher, discussing the rationale for the ETU and its place in the overall curriculum for that grade and subject matter area.

b. Objectives of the unit, stated in performance terms, so that teachers know precisely what learning outcomes are to be achieved. (An example of an objective from the second grade reading ETU is: The child can recognize a base word with a prefix added, with a suffix added, and with both a prefix and suffix added.)

Teachers are allowed to teach all of the ETU objectives or any subset thereof that they may select.

c. A pre-test for the students. (Information from the pre-test results was provided each teacher.)

d. Instructional materials and instructional activities. A wide variety of instructional materials and suggested activities are provided to teachers so they have some choices available while trying to meet the objectives of the ETU. (Teachers were also allowed to use their own ideas and materials to meet the instructional objectives.)

e. A posttest for the students. This is a test of attainment of the unit objectives, and is identical to the pre-test.

The ETUs, including the tests and testing procedures manuals, are provided in Appendices A thru L. A description of each ETU and its development is provided below.

Experimental Teaching Unit for Second Grade Reading

This unit has two sections. One section is on Following Directions. The students are given practice on following simple and complex written directions. Additional exercises work with the understanding of a sequence of events or directions. A major purpose of this section is to increase the child's awareness of the purpose of reading--to understand a message. The child should be able to read something and do what it says.

The second section of this ETU is concerned with Word Structure. Students work with the concept that a word can be made up of parts, each of which has meaning. The meanings of the parts are combined to derive the meaning of the word as a whole. Simple words are combined to form compound words. Root words can be expanded by the addition of a prefix or suffix. The emphasis of unit is on the recognition of meaningful parts in a word, as an aid to the reading process.

The following curriculum materials contributed to the development of this unit:

a. Reading Framework for California Public Schools. Sacramento, California: California State Department of Education, 1973.

b. Ward, B. A. and Skailand, D. B. Teaching Reading as Decoding: Minicourse 18. San Francisco, California: Far West Laboratory for Educational Research and Development, 1973.

c. Textbooks in reading for California public schools adopted by the California State Board of Education.

d. Materials at the curriculum libraries of:

   - San Mateo Unified School District
   - University of California, Berkeley
   - Stanford University

Consultants in the development of this ETU included:

a. Dr. Roger Shuy, Associate Director of the Center for Applied Linguistics and Professor of Linguistics, Georgetown University, Washington, D. C.

b. Mrs. Cheryl Smith, reading specialist and early childhood education resource teacher, San Mateo Unified School District.

The materials were pilot tested in two schools of the Old Adobe Union School District, Petaluma, California. Six second grade teachers provided the information for formative evaluation of these materials.

Experimental Teaching Unit for Second Grade Mathematics

The purpose of this unit is to develop some basic concepts of measurement. The major focus is to build the concepts of length, weight, volume or capacity, and area using arbitrary units of measurement, such as a child's hand. The unit furnishes a variety of experiences which may make these concepts meaningful to a child.

This unit provides a firm foundation for introducing standard units of measurement, which is one of the subtopics. Standard units are defined in metric measurement.

These curriculum materials were chosen after considering the following sources:

a. The second strands report: Mathematics framework for California Public Schools, kindergarten through grade eight. Sacramento, California: California State Department of Education, 1972.

b. Williams, E., and Shurad, H. Elementary mathematics today: A resource for teachers, grades 1 - 8. Reading, Mass: Adison-Wesley, 1970.

c. Minnesota Mathematics and Science Teaching Project. Minneapolis, Minnesota: University of Minnesota, 1967.

d. Horne, S. Learning about measurement. Chicago, Illinois: Rand McNally, 1970.

e. The Nuffield Foundation of England. Beginnings, K-2 and Shape and Size, 1-4. New York: John Wiley, 1970.

f. Various textbooks adopted by the California State Board of Education for use in public schools.

The following professionals were consultants during the development of the second grade mathematics ETU:

a. Mrs. Joan Higgins, math consultant, San Francisco Unified School District.

b. Dr. Raj Prasad, math consultant and acting Assistant Superintendent for Instruction, San Mateo City School District.

c. Dr. Frank K. Lester, Jr., Professor of Mathematics Education, and co-Director of Indiana University Professional Year Program, Indiana University, Bloomington, Indiana.

d. Dr. William D. McKillip, Department of Mathematics Education, University of Georgia, Athens, Georgia.

Experimental Teaching Unit for Fifth Grade Reading

This unit is designed to improve a student's reading comprehension by increasing his understanding of the way language works.

To improve reading for meaning, the student is introduced to the concept of paraphrase. A particular idea can be stated in a number of different ways. The external form of the message can change as sentences are rewritten, but the underlying meaning stays the same. This concept of paraphrase is applied at three levels: (a) different words can be used to represent the same concept (synonyms); (b) sentences can be rewritten to express the same idea; and (c) paragraphs or stories can contain ideas written in different ways.

Another section of the unit gives the student practice in using context clues. As skilled readers process sentences, they use their knowledge of language to make predictions about what words will appear. By integrating words into the larger unit of the sentence or paragraph, a reader can decode words with a minimum of visual cues. The reader relies on the redundancy of language to fill in additional features. Exercises in this section give the students practice in predicting from context.

The curriculum materials consulted for the creation of this ETU included:

a. Reading Framework for California Public Schools. Sacramento, California: California State Department of Education, 1973.

b. Ward, B. A. and Skailand, D. B. Teaching Reading as Decoding: Minicourse 18. San Francisco, California: Far West Laboratory for Educational Research and Development, 1973.

c. Textbooks in reading for the California public schools adopted by the California State Board of Education.

d. Materials at the curriculum libraries of:

- San Mateo Unified School District
- University of California, Berkeley
- Stanford University

Consultants to the project during the development of this ETU included:

a. Dr. Roger Shuy, Associate Director of the Center for Applied Linguistics and Professor of Linguistics, Georgetown University, Washington, D. C.

b. Mrs. Cheryl Smith, reading specialist and early childhood education resource teacher, San Mateo City School District.

These materials were pilot tested at two schools of the Old Adobe Union School District, Petaluma, California. Five teachers provided the information for formative evaluation of the materials.

Experimental Teaching Unit for Fifth Grade Mathematics

In the future, children will be faced with an ever increasing mass of numerical information. To make intelligent decisions, they will need to know something about inquiring into the information (data) that is presented to them as fact. They may learn these skills through the study of probability and the interpretation of graphs.

In this ETU, simple notions of probability are developed by providing children with opportunities to see what might occur in a given situation. For example, a child might be asked: What are my chances of getting a heads when I flip this coin? As children collect information (data), they learn to organize it into a form that can be easily communicated so that they can reliably predict the probability of a given event as being certain, uncertain, or impossible. Children also develop skills in interpreting graphs and charts. This unit focuses on the basic concepts of probability and graphing.

The curriculum materials reviewed in order to create this ETU included:

a. The second strands report: Mathematics framework for California Public Schools, kindergarten through grade eight. Sacramento, California: California State Department of Education, 1972.

b. Heddens, J. W. Today's mathematics: A guide to concepts and methods in elementary school mathematics. Chicago, Illinois: Science Research Associates, Inc., (undated).

c. Kelley, S. J. Learning mathematics through activities: A resource book for elementary teachers. New York: John Wiley, 1972.

d. The Nuffield Foundation of England. Probability and Statistics. New York: John Wiley, 1970.

e. Topics in Mathematics for Elementary Teachers. Book #16, Collecting, Organizing and Interpreting Data. Reston, Virginia: National Council of Teachers of Mathematics, 1969.

f. Instructional Objectives Exchange, Mathematics 4-6. Los Angeles, California: IOX (undated).

g. Buckeye, D. Experiments in Probability and Statistics. Troy, Michigan: Midwest Publications Co., Inc., 1970.

h. Probability Experiments. Fresno, California: Creative Teaching Associates, 1973.

i. Johnson, D., Hansen, V., Peterson, W., Rudnick, J., Cleveland, R., and Bolster, L. C. Activities in Mathematics: First Course, Probability. Glenview, Illinois: Scott, Foresman and Co., 1971.

j. Mathematics Resource Center - Beresford Park School, San Mateo Unified School District, San Mateo, California.

Consultants to the project during the development of this ETU included:

a. Mrs. Joan Higgins, math consultant, San Francisco Unified School District.

b. Dr. Raj Prasad, math consultant and acting Assistant Superintendent for Instruction, San Mateo City Unified School District.

c. Dr. Frank K. Lester, Jr., Professor of Mathematics Education, and co-Director of Indiana University Professional Year Program, Indiana University, Bloomington, Indiana.

d. Dr. William D. McKillip, Department of Mathematics Education, University of Georgia, Athens, Georgia.

These materials were pilot tested in the Old Adobe Union and San Mateo City school districts. Three schools participated in the pilot testing. Six teachers provided information for formative evaluation.

Creation of the Final Versions of the Experimental Teaching Units

A number of revisions in the ETUs were made after formative evaluations were completed. Objectives that were superfluous were deleted, as were their accompanying test items. Materials were added, deleted, or revised on the basis of teacher feedback. Tests were refined on the basis of item analysis and reactivity to instruction. The units were reviewed by a committee of the California Commission for Teacher Preparation and Licensing, and then finalized. The complete set of materials that made up each of the four ETUs is provided in Appendices A thru L.

III. RECRUITMENT OF THE INITIAL SAMPLE OF TEACHERS

The Laboratory staff had decided that the initial recruitment goal was one hundred teachers at each grade level. These teachers would teach the ETUs and, on the basis of their performance, a smaller sample of teachers would be selected. The latter set of classes would be used for the intensive studies. It was decided that the districts in which these teachers work should be generally representative of the major demographic variables of the state of California. This meant inclusion of urban, suburban, and rural population centers as well as concern with representation of the various ethnic groups. It was also intended that teachers be recruited from districts in both northern and southern California, with due consideration for logistical factors such as the general accessibility of the district and the proximity of one participating district to another participating district. An additional consideration was the prior working relationships established with school districts by either the Commission for Teacher Preparation and Licensing or the Far West Laboratory.

Given these criteria, thirteen school districts were selected for initial contact. Grouped by county, these were:

- Los Angeles County
    - Los Angeles City Unified School District
- Ventura County
    - Oxnard Elementary School District
    - Santa Paula Elementary School District
    - Ventura Unified School District
- Sacramento County
    - North Sacramento Elementary School District
    - Sacramento City Unified School District
    - San Juan Unified School District
- Contra Costa County
    - Mt. Diablo Unified School District
- Santa Clara County
    - Oak Grove Elementary School District

Santa Clara County (continued)
    San Jose Unified School District
    Santa Clara Unified School District

Monterey County
    Monterey Peninsula Unified School District
    Salinas City Elementary School District

It was anticipated that these districts would provide the desired demographic representation without creating any unwieldly logistical problems. These districts contained an adequate number of second and fifth grade teachers to reach the recruitment goal of 200 volunteer teachers.

The recruiting procedure required three steps in each school district. Representatives of the California Commission for Teacher Preparation and Licensing and the Far West Laboratory met first with district level administrators, usually the superintendent or his designate. In most cases representatives of teacher associations were present. An explanation of the study was given and consent for the solicitation of teacher volunteers in the district was sought. Second, meetings were held with principals within a district, informing them of the study and providing them with a chance to decline to participate if they so desired. The third step was meeting with teachers, explaining the study, delineating the requirements and advantages of participation, and requesting volunteers for the study. It was not stated that more and less effective teachers were to be chosen from the initial pool of teachers at each grade level. However, it was noted that the achievement gain scores made by their students would be one factor in choosing teachers and classrooms for more intensive analyses. The teachers who participated were all volunteers. On the basis of previous experience, and some preliminary data obtained in other situations where volunteer teachers were recruited, we believe that these teachers are considerably more "open" and more concerned with the improvement of their profession than the typical teacher in the state.

In addition to the meetings with district administrators, principals, and teachers, an invitation was extended to each school district to observe the ongoing Experimental Teaching Unit pilot studies (described above). It was suggested that representatives of teachers associations might desire to observe the teaching of the ETUs so that they could evaluate the educational quality of the ETU lessons. These invitations were not acted upon.

Two districts out of the thirteen contacted, declined to participate. One district noted that a possible teacher strike might occur and that this would interfere with their participation. Another school district believed that its teachers had too heavy a workload and did not think this study could be integrated into their schedules. We will not further identify districts, schools, teachers, or students who participated in this study. That information will remain confidential.

IV. DATA COLLECTION PROCEDURES

During the beginning of October, 1974, each of the students in each of the 94 classrooms recruited to be part of the second grade sample and each of the students in each of the 99 classrooms recruited to be part of the fifth grade sample took a lengthy battery of achievement tests in reading and mathematics. The tests, given in two sessions, consisted of (a) the second grade or fifth grade reading and mathematics subtests of the California Achievement Test (CAT); and (b) specially constructed reading and mathematics tests designed by the Educational Testing Service (ETS) for Phase II of the Beginning Teacher Evaluation Study (see Ekstrom, 1976, for a complete description of this battery.)

In the middle of October, 1974, each of these classes was tested with the reading pre-test appropriate for the reading ETU at its grade level. The pre-test results and the ETU materials were returned to the teachers at the end of October. One week later, generally during early November, 1974, the teachers started instruction in the ETU. Second grade teachers were asked to teach the ETU objectives 20 minutes per day for two weeks. Fifth grade teachers were asked to teach the ETU objectives for 40 minutes per day for two weeks. Post-testing for the reading ETU occurred at the end of instruction, generally before the Thanksgiving break in school, during November, 1974.

The pre-tests for the mathematics ETUs at each grade level were given in early January, 1975. Teachers received the results of these pre-tests, by objective, and the complete ETU materials well before they were to begin classroom instruction in the ETU. Instruction and posttesting were completed within the month of January.

V. RELIABILITY OF THE ETU TESTS

The ETU pre-tests and posttests were analyzed using Cronbach's Alpha, a measure of internal consistency, and were shown to be reliable. In second grade reading, the pre- and posttest measures of reliability for a 65-item test were .75 and .72. In second grade mathematics, the pre- and posttest measures of reliaiblity for a 35-item test were .65 and .77. In fifth grade reading, the pre- and posttest measures of reliability for a 100-item test were .77 and .78. Finally, in fifth grade mathematics, the pre- and posttest measures of reliability for a 48-item test were .69 and .76. These data were from the ETU tests that were given in the 40 known sample classes. The internal consistency reliability is derived from individual student data. Classes, not students, were actually chosen for this study. A classroom level analysis would provide even higher estimates of reliability than those presented above.

The pre-test-posttest correlations, with two weeks of intervening instruction, were also quite high: r = .93 (reading, second grade); r = .81 (mathematics, second grade); r = .97 (reading, fifth grade); r = .91 (mathematics, fifth grade).

As noted previously, the ETU tests and testing manuals are presented, along with the ETUs, in Appendices A thru L.

VI. SELECTION OF THE KNOWN SAMPLE

The pre-test scores in reading and in mathematics were used to divide the sample into three approximately equal size strata at each grade level and within each subject matter area. Within each of the low, middle, and high pre-test score strata, the posttest scores for an ETU were regressed on the pre-test scores and deviation score for each class in the strata was computed. These residualized scores represented the differences between observed and predicted class posttest means. Extreme residualized scores were of two types. One type represented classes whose observed score was well above what was predicted on the basis of pre-test scores for classes in that strata, in that grade and subject matter area, indicating, perhaps, an unusually effective teacher. Another type of extreme score was for a class whose observed score was well below what was predicted on the basis of pre-test scores for classes in that strata, in that grade and subject matter area, indicating, perhaps, a less effective teacher. An extreme score was defined as a deviation from predicted score of ± 1.5 standard deviation units, or more, in z score units (a mean of 0, and a standard deviation of 1.0). Tables 1 - 12 present the data in z score units and identify the outliers chosen for the known sample. The predicted scores in these tables are the predicted posttest scores, given pre-test information about a class. The observed scores are the observed posttest scores for a class.

It was intended that outliers--defined as classes with residualized scores greater than ± 1.5--were to be chosen for the study if they were positive or negative outliers in both reading and mathematics. However, the correlation between residulaized scores in reading and mathematics was only about.30 in second and fifth grade. The relatively low intercorrelations between residuals for reading and mathematics at each grade level made it impossible to find sufficient numbers of teachers judged to be "more" or "less" effective in both subject matter areas. All the teachers identified on the basis of this double criterion were chosen for the study. The sample was augmented by choosing other teachers who were outliers in only reading or mathematics. The goal was to obtain ten teachers who were positive outliers and ten teachers who were negative outliers in each grade level. It should be noted that in no case was a teacher found to be a positive outlier in one subject matter and a negative outlier in the other.

In choosing the known sample of teachers, consideration was given to the testing irregularity reports for each class. These reports were turned in by the field workers as part of their test administration duties. In addition, each field worker visited a class during the time that an ETU was being taught. The notes and rating scales from that observation were also used in making decisions about teachers. All the testing reports, rating scales, and anecdotal records were analyzed, and any classes with unusual problems were eliminated from further consideration. Furthermore, when missing data on one or more sets of data brought the number of complete student records in a class down to 10, the class was also dropped from further consideration. Classes were also chosen to reflect the goal of having representation from northern or southern California, from urban and non-urban school districts, and from all pre-test strata. The decision to have all three pre-test score strata represented in approximately equal numbers was made to insure that a wide range of student socioeconomic status and intelligence was represented in the known sample classes. Both socioeconomic status and intelligence are likely to be strongly correlated with the pre-test scores in the reading and mathematics ETUs. Thus, by requiring equal distribtuion of known sample classes across pre-test strata, a sample with considerable range on these other measures would probably be assured.

The sample of classes (marked with an asterisk in Table 1 thru 12) contain approximately equal numbers of classes from each of the three strata that had been determined on the basis of pre-test scores, and contain approximately equal numbers of classes from northern and southern California. As near as could be determined, other than on the basis of residual scores, the known sample did not differ in any ways that we knew of from the larger pool of teachers from which we started.

Teachers selected for the known sample were contacted during the last week of February, 1975, and arrangements were made to carry out the three studies cited earlier in this report, during the Spring of 1975. These teachers received either an honorarium or college credits for their further participation in the BTES study. The teachers who were not to be included in the known sample were also informed, thanked for their participation, provided an honorarium for their efforts, and released from any further obligations during 1975.

Table 1

Lowest Third of Pre-Test Scores as Measured by the Pre-Test Associated with the Second Grade ETU in Reading

CLASS NUMBER	PRETEST SCORE	PREDICTED SCORE	OBSERVED SCORE	DEVIATION SCORE
52	10.10	14.64	19.30	4.66*
25	12.50	17.50	17.00	-0.50*
154	13.50	18.69	17.50	-1.19
132	15.03	20.51	17.10	-3.41
195	16.93	22.77	18.67	-4.10
149	17.54	23.49	23.25	-0.24
137	18.50	24.63	22.88	-1.74*
168	18.53	24.67	23.20	-1.47
95	19.20	25.46	27.92	2.46*
42	21.70	28.43	28.25	-0.18
162	21.83	28.59	28.54	-0.05*
96	22.04	28.84	31.27	2.43
88	22.43	29.31	27.88	-1.43
102	22.78	29.72	29.21	-0.50
24	23.74	30.86	30.61	-0.25
152	23.88	31.03	27.19	-3.84
153	24.14	31.34	33.04	1.71
7	24.69	31.98	40.81	8.83*
23	25.13	32.51	41.30	8.79
159	25.25	32.65	33.60	0.95
131	25.35	32.77	33.73	0.96
130	25.35	32.77	32.69	-0.07
161	25.52	32.97	35.80	2.82
129	25.68	33.16	30.28	-2.88
19	25.95	33.48	33.80	0.32
144	27.08	34.83	30.96	-3.87
12	27.10	34.85	34.10	-0.75
101	27.17	34.94	31.13	-3.81
51	27.38	35.18	29.13	-6.05*
177	27.58	35.42	37.79	2.37
100	27.95	35.87	35.91	0.04

*Indicates class chosen for the known sample

Table 2

Middle Third of Pre-Test Scores as Measured by the Pre-Test Associated with the Second Grade ETU in Reading

CLASS NUMBER	PRETEST SCORE	PREDICTED SCORE	OBSERVED SCORE	DEVIATION SCORE
166	28.81	35.69	32.67	-3.02
33	29.00	35.87	34.23	-1.64
85	29.15	36.01	37.25	1.24
56	29.18	36.03	36.94	0.91
134	29.23	36.09	40.77	4.68
30	29.54	36.38	35.11	-1.26
82	29.90	36.73	37.04	0.32
143	30.19	36.99	32.67	-4.33
178	30.38	37.18	36.92	-0.26
53	30.61	37.39	38.65	1.26
133	30.91	37.68	37.23	-0.45
127	31.00	37.77	35.42	-2.35
99	31.00	37.77	32.85	-4.92*
117	31.19	37.95	36.29	-1.66*
40	31.50	38.24	41.30	3.06
199	31.60	38.33	41.13	2.80
185	32.27	38.97	47.18	8.21*
184	32.52	39.21	38.38	-0.83*
97	32.68	39.36	42.21	2.85
45	33.31	39.96	42.88	2.91
169	33.64	40.26	34.41	-5.86*
46	33.94	40.56	42.28	1.72
74	34.04	40.65	40.65	-0.00
31	34.12	40.73	40.20	-0.53
54	34.50	41.09	41.81	0.73
6	34.92	41.49	39.69	-1.80
120	34.93	41.50	46.60	5.10*
10	35.00	41.56	45.16	3.60*
55	35.04	41.60	41.13	-0.48
115	35.07	41.63	36.79	-4.84
47	35.29	41.83	38.95	-2.88
186	35.35	41.89	39.61	-2.28

*Indicates class chosen for the known sample

Table 3

Highest Third of Pre-Test Scores as Measured by the Pre-Test Associated with the Second Grade ETU in Reading

CLASS NUMBER	PRETEST SCORE	PREDICTED SCORE	OBSERVED SCORE	DEVIATION SCORE
26	35.87	43.89	41.93	-1.95
103	37.00	44.56	43.00	-1.56
14	37.21	44.69	45.71	1.02
138	37.26	44.72	46.56	1.83
77	37.26	44.72	45.68	0.96
50	37.45	44.83	44.45	-0.38
69	37.65	44.95	43.78	-1.17
105	37.79	45.03	40.46	-4.58*
2	38.19	45.27	50.43	5.16*
68	38.21	45.29	44.36	-0.93
124	38.24	45.30	45.57	0.27
81	38.53	45.47	43.21	-2.26
151	38.54	45.48	45.71	0.23
18	39.10	45.81	44.33	-1.48
119	39.25	45.91	45.90	-0.01
89	39.54	46.08	47.17	1.09
86	39.73	46.19	44.50	-1.69
111	39.87	46.27	47.53	1.26*
196	39.87	46.28	45.65	-0.62
78	40.75	46.80	48.25	1.45
198	40.79	46.83	47.55	0.72
123	40.82	46.85	49.35	2.51*
36	41.42	47.20	51.26	4.06*
112	42.68	47.96	50.47	2.51
16	43.40	48.39	47.96	-0.43
174	43.48	48.43	48.30	-0.14
183	43.62	48.52	46.03	-2.48*
87	44.00	48.74	46.77	-1.97
83	45.46	49.61	49.13	-0.49
176	45.78	49.81	49.83	0.02
13	47.29	50.71	49.75	-0.96

*Indicates class chosen for the known sample

Table 4

Lowest Third of Pre-Test Scores as Measured by the Pre-Test Associated with the Second Grade ETU in Mathematics

CLASS NUMBER	PRETEST SCORE	PREDICTED SCORE	OBSERVED SCORE	DEVIATION SCORE
52	8.70	13.10	11.70	-1.40*
149	9.50	13.93	15.38	1.45
131	9.68	14.12	11.80	-2.32
137	10.04	14.48	18.29	3.80*
130	10.17	14.63	14.48	-0.15
154	10.78	15.26	12.06	-3.20
14	10.82	15.30	16.32	1.02
132	11.47	15.97	13.90	-2.07
178	11.48	15.99	17.52	1.53
129	11.54	16.05	13.92	-2.13
153	11.64	16.15	16.72	0.57
51	11.73	16.25	16.27	0.02*
195	11.88	16.40	15.81	-0.58
100	11.89	16.41	18.30	1.89
144	11.90	16.42	14.35	-2.07
33	11.94	16.47	18.00	1.53
85	12.13	16.66	18.35	1.69
99	12.15	16.68	17.55	0.87*
7	12.20	16.73	23.33	6.60*
82	12.33	16.87	16.54	-0.33
152	12.50	17.05	17.77	0.72
143	12.50	17.05	16.23	-0.82
162	12.57	17.11	14.09	-3.03*
25	12.75	17.31	14.60	-2.71*
177	12.83	17.39	20.79	3.40
88	12.84	17.41	13.38	-4.02
23	13.14	17.71	17.38	-0.33
101	13.18	17.75	14.55	-3.21
134	13.22	17.80	21.09	3.29

*Indicates class chosen for the known sample

Table 5

Middle Third of Pre-Test Scores as Measured
by the Pre-Test Associated with the
Second Grade ETU in Mathematics

CLASS NUMBER	PRETEST SCORE	PREDICTED SCORE	OBSERVED SCORE	DEVIATION SCORE
40	13.33	19.94	17.21	-2.73
103	13.35	19.94	21.38	1.44
102	13.39	19.95	17.78	-2.17
95	13.54	19.99	17.67	-2.32 *
42	13.57	20.00	18.71	-1.28
50	13.58	20.00	20.46	0.46
47	13.65	20.02	22.30	2.28
133	13.65	20.02	20.65	0.64
111	13.73	20.03	23.85	3.81 *
6	13.76	20.04	17.90	-2.14
185	13.78	20.05	23.04	3.00 *
119	13.81	20.05	19.19	-0.86
46	13.85	20.06	18.05	-2.01
115	13.95	20.09	20.90	0.81
53	14.05	20.11	22.37	2.26
120	14.08	20.12	18.58	-1.53 *
97	14.20	20.14	21.16	1.02
112	14.25	20.16	21.68	1.52
123	14.28	20.16	22.88	2.72 *
81	14.45	20.20	19.15	-1.05
24	14.52	20.22	19.57	-0.65
26	14.54	20.22	20.38	0.15
117	14.57	20.23	17.11	-3.12 *
186	14.64	20.25	19.36	-0.89
96	14.74	20.27	21.52	1.25
124	14.91	20.31	20.45	0.14
45	15.00	20.33	22.90	2.57
12	15.05	20.34	18.68	-1.66
18	15.10	20.35	19.60	-0.75
169	15.28	20.40	20.11	-0.29 *
151	15.32	20.41	19.80	-0.61

*Indicates class chosen for the known sample

Table 6

Highest Third of Pre-Test Scores as Measured by the Pre-Test Associated with the Second Grade ETU in Mathematics

CLASS NUMBER	PRETEST SCORE	PREDICTED SCORE	OBSERVED SCORE	DEVIATION SCORE
199	15.43	21.96	20.43	-1.52
19	15.63	22.10	20.25	-1.85
2	15.65	22.12	26.96	4.83*
30	15.79	22.24	21.17	-1.07
166	15.80	22.24	19.70	-2.54
197	15.81	22.26	22.26	0.00
10	15.82	22.26	22.36	0.10*
89	15.95	22.37	21.33	-1.03
105	16.17	22.54	21.17	-1.37*
54	16.17	22.54	22.67	0.13
184	16.39	22.72	19.11	-3.61*
36	16.79	23.04	28.93	5.89*
138	16.83	23.07	23.96	0.89
31	16.85	23.08	22.42	-0.66
69	17.38	23.51	25.19	1.68
74	17.65	23.73	22.30	-1.43
78	17.89	23.92	27.61	3.69
77	17.91	23.94	25.95	2.02
55	18.13	24.11	24.22	0.10
13	18.73	24.59	24.23	-0.37
198	18.89	24.72	26.89	2.16
16	19.19	24.97	23.46	-1.51
196	19.26	25.02	23.26	-1.76
86	19.33	25.08	25.37	0.29
183	19.50	25.21	22.96	-2.26*
83	20.04	25.65	26.00	0.35
87	20.52	26.03	22.00	-3.43
176	20.55	26.05	27.14	1.08
174	21.55	26.86	28.05	1.19

*Indicates class chosen for the known sample

Table 7

Lowest Third of Pre-Test Scores as Measured by the Pre-Test Associated with the Fifth Grade ETU in Reading

CLASS NUMBER	PRETEST SCORE	PREDICTED SCORE	OBSERVED SCORE	DEVIATION SCORE
20	26.89	32.52	31.89	-0.63
5	27.60	33.12	33.13	0.01
158	28.00	33.46	33.86	0.40*
157	29.15	34.43	38.75	4.32*
155	29.52	34.74	35.68	0.94
156	30.00	35.32	33.84	-1.48
190	31.58	36.48	37.19	0.71
60	32.95	37.64	32.25	-5.39
170	33.75	38.31	40.50	2.19
34	34.53	38.97	37.84	-1.13
9	34.58	39.01	37.88	-1.13
121	34.71	39.12	38.06	-1.06*
172	34.95	39.33	39.05	-0.28
65	35.10	39.45	38.25	-1.20*
147	35.43	39.73	40.67	0.94
63	35.58	39.86	43.33	3.47*
150	36.27	40.44	37.50	-2.94
146	37.00	41.06	39.65	-1.40
142	37.68	41.63	40.48	-1.15
193	38.07	41.96	44.46	2.50
140	38.16	42.03	37.72	-4.31*
188	38.20	42.07	44.44	2.37
128	38.52	42.34	43.15	0.81
171	38.53	42.35	44.24	1.89*
145	38.86	42.62	41.64	-0.98
29	38.96	42.71	43.04	0.33
8	39.28	42.98	41.92	-1.06
22	39.48	43.15	43.60	0.45
21	40.17	43.73	45.54	1.81
90	40.69	44.17	47.04	2.87
1	40.71	44.19	42.52	-1.67
136	40.97	44.40	43.40	-1.00
201	41.12	44.53	45.31	0.78

*Indicates class chosen for the known sample

Table 8

Middle Third of Pre-Test Scores as Measured by the Pre-Test Associated with the Fifth Grade ETU in Reading

CLASS NUMBER	PRETEST SCORE	PREDICTED SCORE	OBSERVED SCORE	DEVIATION SCORE
191	42.19	46.15	46.94	0.79
61	42.27	46.23	47.46	1.24
173	42.33	46.29	45.00	-1.29
179	42.50	46.44	45.14	-1.31*
110	42.63	46.56	46.05	-0.53
182	42.92	46.84	47.50	0.66
64	43.08	46.98	48.24	1.26
41	44.11	47.95	47.81	-0.13
194	44.15	47.98	50.90	2.92
72	44.86	48.64	47.14	-1.50
43	44.88	48.66	48.80	0.14
98	45.19	48.96	48.13	-0.83*
80	45.24	50.00	48.33	-0.67
189	45.26	49.02	50.30	1.28
48	46.09	49.80	51.78	1.99*
200	46.59	50.26	50.81	0.55
28	46.84	50.49	45.81	-4.69*
27	47.18	50.81	48.50	-2.31*
106	47.39	51.00	50.42	-0.59
108	48.58	52.12	51.08	-1.04
3	48.84	52.36	53.26	0.90
67	48.86	52.38	51.48	-0.90
141	49.03	52.54	53.91	1.37
109	49.48	52.96	54.74	1.78
122	49.74	53.20	50.65	-2.55*
59	49.76	53.22	53.20	-0.02
39	49.77	53.23	54.15	0.92
57	49.88	53.33	53.24	-0.09
35	50.24	53.67	54.80	1.13
79	50.38	53.80	55.10	1.29*
116	50.50	53.91	53.39	-0.52*
187	50.52	53.93	54.93	1.00
58	50.62	54.02	53.77	-0.25

*Indicates class chosen for the known sample

Table 9

Highest Third of Pre-Test Scores as Measured by the Pre-Test Associated with the Fifth Grade ETU in Reading

CLASS NUMBER	PRETEST SCORE	PREDICTED SCORE	OBSERVED SCORE	DEVIATION SCORE
104	50.63	53.54	55.26	1.72
180	50.90	53.78	54.90	1.12
181	51.00	53.87	53.63	-0.23
118	51.03	53.90	55.62	1.73
126	51.29	54.11	50.57	-3.54*
91	51.33	54.15	55.29	1.14
4	51.67	54.44	57.00	2.56*
135	51.72	54.49	54.28	-0.21
44	51.73	54.50	50.92	-3.58
175	51.78	54.54	56.70	2.16*
73	52.85	54.60	52.67	-1.94
113	52.19	54.90	55.57	0.67
38	52.25	54.95	56.03	1.08
70	52.39	55.08	56.29	1.21
37	52.40	55.08	54.76	-0.32
15	52.40	55.08	54.13	-0.95
139	52.54	55.21	56.97	1.77
114	52.55	55.21	54.45	-0.76
160	52.66	55.30	54.03	-1.27
49	53.83	55.45	54.70	-0.76
62	53.21	55.79	57.34	1.56
107	53.31	55.87	57.38	1.51
76	53.59	56.11	53.96	-2.15
75	54.86	56.35	55.27	-1.08
125	54.09	56.55	55.72	-0.82*
71	54.56	56.96	57.04	0.08
163	55.77	58.01	56.95	-1.06
32	56.86	58.95	56.95	-2.00
165	57.71	59.70	60.96	1.27
84	58.00	59.95	60.00	0.05*
11	58.50	60.38	59.38	-0.50
164	58.83	60.67	60.30	-0.36
66	61.85	63.29	65.19	1.91

*Indicates class chosen for the known sample

Table 10

Lowest Third of Pre-Test Scores as Measured by the Pre-Test Associated with the Fifth Grade ETU in Mathematics

CLASS NUMBER	PRETEST SCORE	PREDICTED SCORE	OBSERVED SCORE	DEVIATION SCORE
20	12.68	16.96	17.89	0.93
21	13.08	17.38	18.17	0.78
34	13.70	18.03	17.60	-0.43
5	16.04	20.50	18.64	-1.86
155	16.33	20.81	19.38	-1.44
9	16.45	20.94	19.27	-1.67
191	16.69	21.19	20.52	-0.67
188	16.83	21.34	20.63	-0.71
32	16.86	21.37	21.91	0.54
29	17.24	21.77	23.00	1.23
190	17.44	21.98	22.85	0.87
172	17.52	22.07	20.19	-1.88
116	17.58	22.13	25.83	3.70*
150	17.80	22.36	21.16	-1.20
156	18.00	22.57	24.22	1.65
1	18.00	22.57	20.30	-2.27
170	18.04	22.61	22.36	-0.25
128	18.32	22.91	25.77	2.87
8	18.32	22.91	21.04	-1.87
136	18.41	23.00	23.15	0.15
180	18.41	23.00	25.65	2.64
158	18.43	23.02	19.71	-3.31*
147	18.90	23.52	23.90	0.38
84	18.95	23.57	28.35	4.78*
3	19.47	24.12	23.47	-0.65
145	19.61	24.26	25.49	1.22
90	19.92	24.60	26.08	1.48
73	20.00	24.68	21.23	-3.45
65	20.09	24.77	20.57	-4.21*
146	20.12	24.80	24.00	-0.80
182	20.23	24.92	27.73	2.81
43	20.24	24.93	25.56	0.63

*Indicates class chosen for the known sample

Table 11

Middle Third of Pre-Test Scores as Measured by the Pre-Test Associated with the Fifth Grade ETU in Mathematics

CLASS NUMBER	PRETEST SCORE	PREDICTED SCORE	OBSERVED SCORE	DEVIATION SCORE
171	20.32	25.57	22.21	-3.36 *
27	20.72	26.11	26.60	0.49 *
62	20.75	26.15	28.05	1.90
189	20.79	26.19	23.61	-2.59
140	20.90	26.35	27.65	1.30 *
110	20.95	26.41	24.90	-1.51
48	20.95	26.41	27.86	1.44 *
121	21.06	26.56	29.94	3.38 *
60	21.23	26.78	24.50	-2.28
67	21.29	26.86	29.33	2.48
15	21.37	26.97	24.93	-2.04
173	21.39	27.00	26.43	-0.56
193	21.43	27.05	27.93	0.88
108	21.57	27.23	31.87	4.64
22	21.63	27.31	28.00	0.69
106	21.93	27.71	27.41	-0.30
141	22.07	27.89	29.10	1.21
122	22.09	27.93	27.55	-0.38 *
70	22.13	27.97	29.96	1.99
201	22.33	28.25	25.15	-3.10
28	22.34	28.26	24.31	-3.95 *
114	22.38	28.31	26.45	-1.86
58	22.86	28.95	30.05	1.10
61	23.07	29.23	26.48	-2.75
181	23.07	29.23	31.11	1.88
142	23.24	29.45	28.24	-1.21
63	23.56	29.88	33.38	3.50 *
80	23.58	29.90	27.42	-2.48
118	23.75	30.13	31.50	1.37
59	23.79	30.17	28.36	-1.82
35	23.79	30.18	32.33	2.15
72	23.80	30.19	29.80	-0.39
200	23.81	30.20	30.77	0.57
113	23.82	30.22	29.82	-0.40

*Indicates class chosen for the known sample

Table 12

Highest Third of Pre-Test Scores as Measured by the Pre-Test Associated with the Fifth Grade ETU in Mathematics

CLASS NUMBER	PRETEST SCORE	PREDICTED SCORE	OBSERVED SCORE	DEVIATION SCORE
194	23.93	29.30	28.59	-0.71
44	24.09	29.46	26.61	-2.85
179	24.10	29.47	32.52	3.04*
39	24.42	29.81	29.65	-0.17
38	24.50	29.90	29.91	0.01
76	24.95	30.38	32.40	2.02
125	24.95	30.38	33.27	2.89*
126	25.43	30.88	29.71	-1.17*
71	25.55	31.01	31.60	0.58
57	25.74	31.22	28.19	-3.03
41	26.33	31.84	29.43	-2.42
49	26.43	31.95	32.70	0.74
175	26.45	31.97	30.64	-1.34*
139	26.63	32.16	33.74	1.59
109	26.73	32.27	32.27	0.00
98	26.77	32.30	25.93	-6.37*
104	26.79	32.32	33.79	1.46
4	28.04	33.65	35.15	1.50*
91	28.17	33.80	33.74	-0.06
187	28.20	33.82	35.17	1.34
37	28.23	33.85	32.90	-0.95
107	28.40	34.04	35.30	1.26
165	28.83	34.50	36.97	2.47
163	28.87	34.54	33.30	-1.23
64	28.93	34.60	35.77	1.16
75	29.41	35.11	36.28	1.16
135	29.45	35.15	33.84	-1.31
11	29.96	35.69	36.67	0.98
160	30.30	36.06	37.39	1.34
66	31.04	36.84	38.78	1.94
79	32.71	38.61	35.39	-3.22*
164	32.73	38.63	37.96	-0.67

*Indicates class chosen for the known sample

VII. VALIDITY STUDY OF THE KNOWN SAMPLE

The 40 classes of the known sample, ten positive and ten negative outliers in both second and fifth grades, all took the larger battery of tests developed by the Educational Testing Service (ETS). These tests were administered early in the fall of 1974 and readministered late in the spring of 1975. It is of interest to compare the selection of the more and less effective teachers, as chosen on the basis of the performance of their classes on reading and mathematics tests after two weeks of teaching, with the performance of the same classes on tests that cover the academic year. By examining students who have complete data on all tests, information can be obtained about whether the decisions made about teachers on the basis of two weeks of teaching are at all similar to those which might have been made on the basis of an academic year of instruction.

The data file for the 40 known sample teachers contains: the ETU pre-test in reading; the ETU posttest in reading; the California Achievement Test (CAT), as a pre-test in reading; the CAT as a posttest in reading; the Educational Testing Service (ETS) items as a pre-test in reading; and the ETS items as a posttest in reading. The same six tests were administered in the subject area of mathematics. There were second and fifth grade versions of both the reading and the mathematics tests. Table 13 presents the intercorrelations among the pre-tests, posttests and the gain scores for all the second grade data. Table 14 presents the same information for all fifth grade data.

Unfortunately, inadequate resources only permitted the administration of the CAT and ETS posttest for the 40 teachers identified through the techniques described above. Thus, there are some difficulties in attempting to examine the validity of the selection procedures because the criterion measures used are

Table 13

Intercorrelations Between Reading and Mathematics Pretests, Posttests, and Gain Scores For Twenty Second Grade Known Sample Classes

		ETU Reading			CAT Reading			ETS Reading			ETU Mathematics			CAT Mathematics			ETS Mathematics		
		Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain
ETU Reading	Pre	X	.87	-.02	.90	.81	.01	.96	.90	-.25	.80	.75	.39	.81	.79	.28	.76	.83	-.09
	Post		X	.47	.79	.87	.25	.94	.93	-.08	.70	.87	.63	.64	.66	.27	.60	.69	-.01
	Gain			X	-.01	.31	.49	.19	.30	.30	-.03	.42	.59	-.15	-.08	.06	-.16	-.08	.13
CAT Reading	Pre				X	.77	-.18	.88	.80	-.29	.79	.60	.20	.75	.76	.31	.69	.83	.02
	Post					X	.48	.88	.81	-.29	.64	.72	.48	.63	.60	.19	.54	.64	.01
	Gain						X	.16	.14	-.06	-.11	.30	.50	-.05	-.13	.14	-.12	-.15	-.01
ETS Reading	Pre							X	.95	-.23	.75	.80	.48	.78	.75	.24	.71	.78	-.08
	Post								X	.10	.71	.79	.50	.68	.76	.40	.68	.76	-.06
	Gain									X	-.16	-.05	.05	-.35	.01	.45	-.14	-.11	.06
ETU Mathematics	Pre										X	.67	.14	.81	.77	.24	.80	.82	-.16
	Post											X	.83	.58	.54	.15	.41	.65	.22
	Gain												X	.17	.14	.02	-.06	.25	.41
CAT Mathematics	Pre													X	.76	.03	.71	.78	-.16
	Post														X	.65	.80	.85	-.12
	Gain															X	.34	.41	.01
ETS Mathematics	Pre																X	.75	-.55
	Post																	X	.14
	Gain																		X

Table 14

Intercorrelations Between Reading and Mathematics Pretests, Posttests, and Gain Scores For Twenty Fifth Grade Known Sample Classes

		ETU Reading			CAT Reading			ETS Reading			ETU Mathematics			CAT Mathematics			ETS Mathematics		
		Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain
ETU Reading	Pre	X	.91	-.43	.84	.85	.16	.84	.90	-.21	.35	.54	.41	.31	.32	.06	.49	.39	-.28
	Post		X	-.02	.84	.88	.21	.78	.90	-.10	.38	.50	.41	.41	.44	.10	.53	.49	-.16
	Gain			X	-.20	-.14	.07	-.31	-.22	.29	-.02	-.09	-.10	.15	.18	.09	-.03	.12	.34
CAT Reading	Pre				X	.82	-.14	.76	.78	-.25	.44	.52	.30	.43	.36	-.07	.54	.43	-.32
	Post					X	.45	.71	.83	-.08	.28	.45	.36	.31	.43	.26	.39	.37	-.10
	Gain						X	.05	.21	.25	-.20	-.03	.16	-.13	.17	.56	-.17	-.04	.32
ETS Reading	Pre							X	.88	-.59	.34	.54	.42	.33	.37	.11	.42	.32	-.27
	Post								X	-.14	.35	.57	.46	.31	.35	.11	.45	.44	-.09
	Gain									X	-.11	-.16	-.11	-.16	-.17	-.04	-.10	.08	.42
ETU Mathematics	Pre										X	.71	-.01	.83	.70	-.14	.78	.78	-.10
	Post											X	.70	.66	.75	.25	.69	.75	.05
	Gain												X	.10	.36	.50	.18	.27	.17
CAT Mathematics	Pre													X	.85	-.15	.77	.85	.07
	Post														X	.39	.69	.81	.17
	Gain															X	-.07	.02	.19
ETS Mathematics	Pre																X	.91	-.34
	Post																	X	.08
	Gain																		X

based on a limited and already pre-selected sample of teachers. In addition, we have confined these analyses to an examination of gain scores, a measure of student performance that is known to have some psychometric problems. Nevertheless, for a preliminary inquiry into issues of the validity of ETU procedures for teacher selection, the gain score analyses will suffice. As shown in Table 13, at the second grade level, the ETU gain score in reading was related to gain in the CAT and ETS reading tests. If the latter tests, with a year long interval between administration, may be considered criterion tests, then the validity coefficient of .49 between ETU reading gain and CAT reading gain and the validity coefficient of .30 between ETU reading gain and ETS reading gain may be considered quite adequate for identifying a select and extreme group of teachers for the study of teaching. Validity coefficients of even .20 may be very useful for selection at the extremes of a distribution. It appears that the reading ETU at second grade, with only two weeks between pre-test and posttest, has some validity for selection.

The ETU mathematics gain scores did not correlate with the CAT mathematics gain scores (r = .02), but did correlate quite highly with the ETS mathematics gain scores (r = .41). This lack of validity using one test as criterion and substantial validity using another test as criterion is odd since the CAT mathematics posttest and the ETS mathematics posttest correlate .85. The ETU procedure, as judged against a year long measure of the activities measured in the ETS battery, appears to be valid.

At the fifth grade level, the ETU reading gain score did not correlate well with the CAT reading tests (r = .07) but showed some validity when the ETS reading tests were used as the criterion (r = .29). In the mathematics area, the ETU gain score based on two weeks of instruction and the CAT mathematics gain score over an academic year correlated .50. This is a very strong indication of validity. The ETU mathematics gain scores only correlated .17 with the ETS mathematics gain scores in fifth grade.

Another factor may be noted from the intercorrelations of gain scores presented in Tables 13 and 14. The association of ETU gain scores with gain scores for the two tests of year-long growth compares favorably with the assocation between gain scores for each of the two year-long measures themselves.

Overall, given that the use of ETUs in the identification of more and less effective teachers was a relatively new procedure, these preliminary and simple checks of validity indicate that the ETUs administered over a two-week time period can be used successfully as a surrogate for year-long growth. With refinement, it is likely that the ETUs can adequately identify extreme groups of more and less successful teachers.

It may also be noted that the use of the CAT or ETS tests as a criterion measure is subject to criticism. The case could be made that these kinds of tests, which are so general as to be only peripherally related to what any given teacher does in his or her own class, should be validated against the ETU tests. The ETU controls the curriculum, time, and objectives taught, as well as providing standardized testing procedures. All in all, it is likely that a teacher's ability to affect student growth in particular areas is best measured by the ETU and not by the more general achievement tests in reading and mathematics. It appears that the face validity of the ETU procedures as a method of selecting more and less effective teachers is higher than the face validity of the general purpose test for that kind of selection.

Another way to examine the issue of validity in selection is to consider the gain scores themselves, without using correlations as the method for analyses. Table 15 presents the second grade data for gain scores in the ETU, CAT, and

ETS measures. Table 16 presents the fifth grade data for gain scores in these same tests. These data are raw score gains on the various tests.

On the CAT and ETS tests, in all but one case, the mean gains of the teachers identified as more effective on the basis of class performance following two weeks of teaching the ETU were higher than teachers identified as less effective. This is another reason to believe that the ETU methodology was valid for the selection of the known sample.

Table 15

Mean Gains on Various Tests for Second Grade Teachers Identified as More and Less Effective

		Mean Raw Score Gains	
	Test	More Effective Teachers	Less Effective Teachers
READING	ETU	12.38	.21
	CAT	9.64	3.04
	ETS	8.20	6.81
MATHEMATICS	ETU	10.02	2.30
	CAT	17.28	16.89
	ETS	2.01	.94

Table 16

Mean Gains on Various Tests for Fifth Grade Teachers Identified as More and Less Effective

		Mean Raw Score Gains	
	Test	More Effective Teachers	Less Effective Teachers
READING	ETU	6.83	- .81
	CAT	1.89	2.13
	ETS	3.69	2.62
MATHEMATICS	ETU	8.50	.95
	CAT	4.39	1.67
	ETS	.98	.61

VIII. CRITICAL RESPONSES TO ETUs

Following the teaching of each ETU, teachers filled out a questionnaire about their experiences while implementing the unit. These records provided an opportunity to check whether teachers in the known sample followed the directions for the unit, particularly as far as allocating equal amounts of instructional time. There were no consistent or striking differences between more and less effective teachers in terms of time spent, classroom organization, or use of materials and activities. Many teachers in both groups taught the ETUs to the whole class.

These questionnaires, along with a debriefing session with teachers, provided useful feedback about the ETUs as research tools. Many teachers felt that too many objectives had been included for such a short period. Teachers also noted that the allocation of two weeks of completion of an ETU may be unrealistic, particularly when many objectives are listed. Because special events occur (fire drills, assemblies) and conflicting instructional activities sometimes occur (field trips, guest speakers), teachers suggested that researchers schedule a few more days than necessary for instruction. This added measure of flexibility would permit a teacher to accomplish the 10 days of instruction over, say 13 days, when necessary.

Teachers also commented that the materials were "disorganized" and "not well matched to the objectives." In part, these comments reflect a misunderstanding of the purpose of the ETUs. The ETUs were constructed in such a way as to force the teacher to plan instruction. The ETUs provided a framework within which the teacher was encouraged to select and sequence objectives, match materials to objectives, and organize and adapt the materials and activities for actual classroom use. The units were, therefore, "disorganized" because it was considered desirable that the teacher personally organize them.

When one teacher commented that the ETUs "*seemed to be testing the teacher*," she was right. This type of activity is, however, unfamiliar to many teachers. Teachers tend to expect something like a commercially published "package" of curriculum, laid out in detail and ready to be administered. Our curriculum units ran counter to this expectation.

Advisers to the Commission also commented on this aspect of the organization of the ETUs. Some advisers felt that because the units did not follow one clear model or organized approach to instruction they were unfamiliar situations for the teacher and hence would not elicit "typical" teaching behavior. Other advisers felt that because teachers tend to infer requirements from the layout of a unit (such as teaching all the stated objectives) the ETUs had been too directive and structured. It is clear that the issue of what to control, and to what degree, is a complicated one. And the interrelationship of curriculum and teaching behaviors is fundamental to the issue.

The goal of the ETU involved two partially contradictory elements--to provide a standardized situation in which to compare teachers and to preserve the range of variability in teacher behavior. It was felt that providing all teachers with a common domain of objectives was an essential basis for comparison but that providing all teachers with the same instructional route to those goals would overcontrol the teaching situation.

It seems possible, however, to keep this basic approach to ETU controls and still make the units more approachable for teachers. In future use, few objectives should be covered. (Low gain scores as well as teacher comments suggest this.) It would also be possible to organize the material into greater numbers of smaller subunits, thus providing more organization but leaving the teacher free to choose the elements within subunits or to vary the order of subunits.

IX. SUMMARY

The ability to identify relatively more and less effective teachers, in order to study some aspects of teaching, was a crucial part of the Laboratory's design for Phase III-A of the Beginning Teacher Evaluation Study. The special sample of teachers was obtained through a series of steps that included (a) recruiting almost 100 teachers at grade 2 and almost 100 teachers at grade 5; (b) testing all the students in these classrooms in reading and mathematics using the California Achievement Test (CAT) and specially constructed tests developed by the Educational Testing Service (ETS); (c) providing all teachers with a two-week long curriculum unit in reading, called an Experimental Teaching Unit (ETU), which allows for the measurement of student performance in the ETU through administration of identical pre-tests and posttests; (d) providing all teachers with a two-week long ETU in mathematics that also allows for the measurement of student performance through the administration of identical pre-tests and posttests; and (e) computing residualized gain scores for each class in order to judge the relative performance of teachers. These procedures led to a choice of ten more and ten less effective teachers at each grade level.

This sample of teachers was used to conduct three studies. In all three studies the investigators tried to contrast the behavior of the more effective and less effective teachers. All of the collection of data and the preliminary analyses were performed without the investigators' knowledge of which teachers had been labeled more or less effective. The data from those studies (see Tikunoff, Berliner, and Rist, 1975; Morine and Valance, 1975; and Morine and Vallance, 1976) have proven useful. The evidence to date indicates that the development of a special sample of teachers, representing extreme groups on measures of effectiveness, can be very useful in the study of teaching.

In addition, validity studies of the procedures used for selection of this sample were carried out. The ETU gain scores from two weeks of instruction were correlated with either the California Achievement Test or the tests developed by the Educational Testing Service, both of which measured gains over the academic year. This analysis revealed sufficient validity for purposes of selecting extreme groups of effective teachers.

The use of ETUs to select extreme groups of more and less effective teachers, in order to study various aspects of the teaching-learning process, has been judged successful. But much further work needs to be done on both the ETUs and methods of measuring changes in student achievement if the techniques are to become very useful to researchers who study teaching. In addition, there are moral issues affecting the use of ETUs. The teachers in this sample were volunteers who were willing to let researchers experiment with these methods in the hope that teacher education programs could be improved. The operational use of ETUs in judging teacher competence is not yet warranted, and it is possible that these techniques may never be reliable or valid enough to be used in hiring, firing, tenure, or promotion decisions. At this point in time the use of ETUs for selection of more and less effective teachers is useful in research on teaching, and it is recommended that they be adopted for those purposes. The ETUs described in this report are not recommended as evaluation instruments.

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APPENDIX A

TEST GIVEN AS PRETEST
AND POST TEST FOR THE
SECOND GRADE ETU IN READING

Part 1. Following Directions

Name ____

First Last

1. Put an X under a pet.

girl dog boy farm

2. Circle the number nine.

6 8 9 5

3. Put a box around the name of a boy.

ball fox car Bob

Below are some sentences. They give you directions to do something. Read the sentences.

1. Get paper, pencil and crayons.
2. Write your name on your paper.
3.
4. Hang up your colorful picture.

Sentence number 3 is missing. Read the sentences below. One of them fills in the missing direction. Put an "X" in the box by the sentence that fills in number 3.

☐ Get the crayons.

☐ Talk to your teacher.

☐ Color your picture.

A-4

Below are some sentences. Read the sentences.

1. Walk to the store.
2. Get a can of pop.
3. Pay the man for the pop.
4.

Sentence number 4 is missing. Put an "X" in the box by the sentence that fills in number 4.

☐ Throw the can away.

☐ Drink your pop.

☐ Play ball with Tom.

Below are some sentences. Read the sentences.

1. Put away your books.
2.
3. Walk to the lunch room.
4. Eat your lunch.

Sentence number 2 is missing. Put an "X" in the box by the sentence that fills in number 2.

[ ] Line up by the door.

[ ] Do your homework.

[ ] Go to the playground.

The lines below make up a story. But they are mixed up and in the wrong order. Read all the lines. Put a number 1 in front of what would come first. Then put a number 2 in front of what would come next. Number all the lines in the story.

[ ] Dan hit a home run.

[ ] Dan is up to bat.

[ ] He has two strikes against him.

Now read this mixed-up story. Number the lines in order.

[ ] The firemen jumped into the big red car.

[ ] All the firemen went to get their hats and coats.

[ ] A fire bell rang in the firehouse.

[ ] They were in time to put out the fire.

Below, draw a circle.
Put a line above the circle.
Put an X across the circle.

Below, draw a tree with three oranges.

Part 2. Word Structure

Name ____
First Last

Read the word. Draw a line through the word to make two parts. Draw the line wherever it makes sense to you.

Example: cow|boy in|side

read|ing farm|er

11 postman

12 teacher

13 bulldog

14 sleepless

15 rewrite

16 waiting

17 undress

18 sandbox

19 shortest

20 wishful

21 rainy

22 wanted

23 bedroom

24 outward

25 runs

26 faster

Here are some silly nonsense words. You have never read these words before. Draw a line through the word to make two parts, just like you did before. Draw the line wherever it makes sense to you.

27 ronding

28 cludful

29 rory

30 unturg

31 goller

32 bipeel

33 rehud

34 daded

35 binly

36 gotman

Here are some long words. Draw two lines in each word.

Example: hope|less|ly

37 unfriendly

38 disliking

39 recounted

40 faithfully

41 uneaten

42 longingly

43 dishwasher

44. Circle the word that means a person who paints.

painter

painting

repaint

45. Circle the word that means a person is not kind.

kindly

unkind

kindness

46. Circle the word that means a thing with 3 cells.

bicell

tricell

unicell

47. Circle the word that means to work something over again.

worker

worked

rework

48. Circle the word that means a person is without hope.

hopeless

hopeful

hoping

49. Circle the word that means someone did something not now but in the past.

jumps

jumping

jumped

50. Circle the word that means someone has lived the most years.

old

older

oldest

51. Circle the word that means in the direction of home.

homer

homeward

homeless

Read the story. Sometimes a word is left out. Look at the words under the blank. Circle the word that fits best in the blank.

52. Mary helps her mother at home. She sets the table and dries the dishes.
Mary is a very ______________ girl.

helper

helpful

helpless

53. John has bad luck. He lost his lunch money. His new toy broke. John is very _________.

lucky

unlucky

luckier

54. Mary played hard all day. By night time she felt tired and ____________.

sleepy

sleeper

sleeping

Read the story. Sometimes a word is left out. Look at the words under the blank. Circle the word that fits best in the blank.

Every day I walk to school.

55. My friend ___________ with me each day.

walks

walked

walking

We want to get to school and play.

56. So we always walk _________ up the street.

quick

quicker

quickly

57. We talk to each other as we are _____________.

walker

walking

walked

APPENDIX B

TESTERS MANUAL FOR
ADMINISTRATION OF THE PRETEST AND POST TEST
ACCOMPANYING THE SECOND GRADE ETU IN READING

TESTER'S MANUAL

Experimental Teaching Unit

Reading - Grade 2

General Information

At the beginning of the test session, give the teacher a copy of the test. Say something like " YOU MIGHT WANT TO LOOK THROUGH A COPY OF THE TEST." Let the teacher keep the test during the test session, but be sure to get the test back at the end of the session. Do not let the teacher keep a copy of the test. Explain to the teacher that the Unit should cover this general area of reading skill rather than the specific items on the test. Point out that the Materials pages in the Unit are very similar to the test items.

During the testing, it will be necessary to circulate around the room, making sure that students have understood the directions correctly. A student who is confused may raise his hand for help. If this happens, repeat the instructions to the child. You may point out to him where he is supposed to read and mark. But do not help him answer the questions. And do not read any words for the child.

The teacher may want to help circulate and answer questions. This is permissable as long as the teacher understands that he may only repeat the instructions and may not read words for the child or try to explain the task more clearly.

Some children at lower reading levels will find the exercises frustrating. Try to encourage such children to figure out what they can. Say something like:

I KNOW SOME OF THE QUESTIONS ARE DIFFICULT. YOU ARE HELPING US FIND OUT WHICH THINGS ARE HARD TO DO. TRY TO FIGURE OUT WHATEVER YOU CAN ON YOUR OWN.

Grade 2

Before beginning testing, make sure that desks are clear, and that each child has a pencil. Try to seat children some distance apart or put dividers between children.

> GOOD MORNING, BOYS AND GIRLS. TODAY WE WOULD LIKE YOU TO DO SOME READING EXERCISES. WE WANT TO FIND OUT WHAT THINGS ARE EASY AND WHAT THINGS ARE HARD FOR BOYS AND GIRLS YOUR AGE TO DO. YOU CAN HELP US BY DOING YOUR BEST WORK ON THESE READING EXERCISES.
>
> NOW I WILL PASS OUT THE WORK BOOKLETS. ON THE FIRST PAGE, PRINT YOUR FULL NAME, BOTH YOUR FIRST NAME AND YOUR LAST NAME. DO NOT OPEN THE BOOKLET.

Pass out the booklets. Let the teacher help with last names.

> WHEN YOU HAVE FINISHED PRINTING YOUR NAME, LOOK UP AT ME, SO I WILL KNOW YOU ARE READY TO BEGIN.

This procedure is useful on a test with many short sections, so time is not lost trying to tell whether everyone is finished. When all are ready, begin the test.

Page 1:

> OPEN YOUR BOOKLETS TO PAGE 1......PAGE 1 GIVES YOU THREE DIRECTIONS TO DO SOMETHING. READ THE DIRECTIONS AND DO WHAT THEY TELL YOU TO DO. I CAN'T HELP YOU READ THE WORDS, SO JUST TRY TO FIGURE IT OUT AS WELL AS YOU CAN. DO THE WHOLE PAGE. BEGIN.

Pause while the children turn the page, then read the remaining directions. Let the children work through the page. If a child asks a specific question, say "WHATEVER YOU THINK," or "THAT'S FINE." When most children have finished say:

> WHEN YOU HAVE FINISHED, LOOK UP AT ME, SO I'LL KNOW YOU ARE READY TO GO ON.

When all children have finished, go on.

Page 2:

TURN TO PAGE 2....... IT SAYS: "BELOW ARE SOME SENTENCES. THEY GIVE YOU DIRECTIONS TO DO SOMETHING. READ THE SENTENCES.

LET'S DO THIS PART TOGETHER. YOU READ THE SENTENCES TO YOURSELF WHILE I READ THEM ALOUD:

NO. 1. GET PAPER, PENCIL, AND CRAYONS.
NO. 2. WRITE YOUR NAME ON YOUR PAPER.
NO. 3. ...... IS MISSING
NO. 4. HANG UP YOUR COLORFUL PICTURE.

"SENTENCE NUMBER 3 IS MISSING. READ THE SENTENCES BELOW. ONE OF THEM FILLS IN THE MISSING DIRECTION. PUT AN "X" IN THE BOX BY THE SENTENCE THAT FILLS IN NUMBER 3."

Read the sentences slowly and deliberately, so slow readers can follow. Pause while the children mark the box. When all children have finished, go on.

Page 3:

TURN TO PAGE 3...... THIS IS THE SAME KIND OF QUESTION. IT SAYS: "BELOW ARE SOME SENTENCES. READ THE SENTENCES. SENTENCE NUMBER 4 IS MISSING. PUT AN "X" IN THE BOX BY THE SENTENCE THAT FILLS IN NUMBER 4." YOU DO THIS PAGE ON YOUR OWN.

Make sure all children are on the right page and mark correctly.

WHEN YOU HAVE FINISHED, LOOK UP AT ME, SO I'LL KNOW YOU ARE READY TO GO ON.

When all children have finished, go on.

Page 4:

TURN TO PAGE 4.... THIS IS ANOTHER QUESTION LIKE THE LAST ONE. READ THE SENTENCES. PUT AN "X" IN THE BOX BY THE SENTENCE THAT FILLS IN NUMBER 2.

Make sure all children are on the right page and mark correctly.

WHEN YOU HAVE FINISHED, LOOK UP AT ME.

When all children have finished, go on.

Page 5:

NOW TURN TO PAGE 5.... WE ARE GOING TO DO SOMETHING DIFFERENT. LISTEN CAREFULLY SO YOU WILL KNOW WHAT TO DO. THE DIRECTIONS SAY: "THE LINES BELOW MAKE UP A STORY. BUT THEY ARE MIXED UP AND IN THE WRONG ORDER. READ ALL THE LINES. PUT A NUMBER 1 IN FRONT OF WHAT WOULD COME FIRST IN THE STORY. THEN PUT A NUMBER 2 IN FRONT OF WHAT WOULD COME NEXT. NUMBER ALL THE LINES IN THE STORY."

LET'S WORK ON THE FIRST ONE TOGEHTER. YOU READ THE SENTENCES TO YOURSELF WHILE I READ THEM ALOUD.

DAN HIT A HOME RUN.
DAN IS UP TO BAT.
HE HAS TWO STRIKES AGAINST HIM.

YOU NUMBER THE LINES SO THEY MAKE SENSE AS A STORY.

Check that the children are numbering and not making "X's". If they need to be corrected say"MARK THESE WITH NUMBERS, NUMBER 1, NUMBER 2, AND NUMBER 3, SO IT MAKES SENSE AS A STORY."

When all have finished, go on to the second story:

NOW LOOK AT THE BOTTOM OF THE PAGE. THE DIRECTIONS SAY: "NOW READ THIS MIXED-UP STORY. NUMBER THE LINES IN ORDER." LET'S READ THE LINES TOGETHER. YOU READ SILENTLY WHILE I READ ALOUD:

THE FIREMEN JUMPED INTO THE BIG RED CAR.
ALL THE FIREMEN WENT TO GET THEIR HATS AND COATS.
A FIRE BELL RANG IN THE FIREHOUSE.
THEY WERE IN TIME TO PUT OUT THE FIRE.

YOU NUMBER THE LINES SO THEY MAKE SENSE AS A STORY.

Make sure the children are marking correctly. When all have finished, go on.

Page 6:

NOW TURN TO PAGE 6..... THIS PAGE GIVES YOU DIRECTIONS TO DRAW SOME THINGS. READ THE DIRECTIONS AND DRAW WHAT THEY TELL YOU TO DRAW. JUST USE YOUR PENCIL TO DRAW WITH. I CAN'T HELP YOU WITH THE WORDS, SO JUST FIGURE IT OUT THE BEST YOU CAN.

If a child is unsure of where to draw his picture, and asks for help, help him with the word "below." As the children are finishing the second picture, after about 1 minute, say:

PLEASE FINISH YOUR DRAWINGS NOW.

After about 15 more seconds, say:

TURN THE PAGE.

Pause while children turn.

Part 2:

YOU HAVE FINISHED THE FIRST PART OF THE BOOKLET. YOU'RE ABOUT HALF-WAY THROUGH. LET'S REST A MINUTE AND GET READY FOR PART 2. WHILE YOU ARE RESTING, PRINT YOUR NAME ON THIS PAGE.

Pause for about 30 seconds, then say:

PLEASE FINISH WRITING YOUR NAME, THEN LOOK UP AT ME, SO I'LL KNOW YOU ARE READY TO GO ON.

When you have the students' attention, go on

TURN TO PAGE 7..... IT SAYS "READ THE WORD. DRAW A LINE THROUGH THE WORD TO MAKE TWO PARTS. DRAW THE LINE WHEREEVER IT MAKES SENSE TO YOU."

LOOK AT THE EXAMPLES: "COWBOY, INSIDE, READING, FARMER." LOOK CAREFULLY AT WHERE WE DIVIDED THESE WORDS.

YOU READ THE REST OF THE WORDS. DIVIDE THEM WHEREVER IT MAKES SENSE TO YOU. DRAW ONE LINE IN EACH WORD.

Circulate around the room to make sure the children are marking correctly. If children ask about the numbers, say "DON'T WORRY ABOUT THE NUMBERS. THEY ARE TO HELP US IDENTIFY THE ITEMS." Do not let the children go on beyond this page. As most children are finishing, say:

PLEASE FINISH UP THE PAGE. WHEN YOU HAVE FINISHED, LOOK UP AT ME.

Pause about 15 seconds, or until most of the children have finished.

IF YOU HAVEN'T FINISHED, YOU CAN FINISH LATER. NOW TURN TO PAGE 8....... "HERE ARE SOME SILLY NONSENSE WORDS. YOU HAVE NEVER READ THESE WORDS BEFORE. DRAW A LINE THROUGH THE WORD TO MAKE TWO PARTS, JUST LIKE YOU DID BEFORE. DRAW THE LINE WHEREVER IT MAKES SENSE TO YOU."

As most children are finishing, say:

WHEN YOU HAVE FINISHED THIS PAGE, LOOK UP AT ME.

Pause about 10 seconds, or until most of the children have finished.

NOW TURN TO PAGE 9...... "HERE ARE SOME LONG WORDS. DRAW TWO LINES IN EACH WORD."

LOOK AT THE EXAMPLE: "HOPELESSLY." LOOK AT WHERE WE DIVIDED THE WORD. NOW YOU DO THE REST OF THESE WORDS. DRAW TWO LINES IN EACH WORD.

As most children are finishing, say

PLEASE FINISH THE PAGE, THEN LOOK UP AT ME.

Pause about 10 seconds, or until most of the children have finished.

Page 10:

NOW TURN TO PAGE 10...... WE ARE GOING TO DO THIS PAGE TOGETHER. LOOK AT THE SENTENCE MARKED 44. IT SAYS: "CIRCLE THE WORD THAT MEANS A PERSON WHO PAINTS."

YOU READ THE 3 WORDS UNDER THAT SENTENCE. CIRCLE THE WORD THAT MEANS A PERSON WHO PAINTS.

. . . .

45. CIRCLE THE WORD THAT MEANS A PERSON IS NOT KIND.....A PERSON IS NOT KIND.

. . . .

46. CIRCLE THE WORD THAT MEANS A THING WITH 3 CELLS.... A THING WITH 3 CELLS.

. . . .

47. CIRCLE THE WORD THAT MEANS TO WORK SOMETHING OVER AGAIN.... TO WORK SOMETHING OVER AGAIN.

. . . .

Pause about 2 seconds before repeating the item and about 5 seconds between items.

Page 11:

TURN TO PAGE 11..... THESE ARE MORE QUESTIONS LIKE THE LAST ONES. LOOK AT NUMBER

48. CIRCLE THE WORD THAT MEANS A PERSON IS WITHOUT HOPE.... A PERSON IS WITHOUT HOPE.

. . . .

49. CIRCLE THE WORD THAT MEANS SOMEONE DID SOMETHING, NOT NOW BUT IN THE PAST....SOMEONE DID SOMETHING NOT NOW BUT IN THE PAST.

. . . .

50. CIRCLE THE WORD THAT MEANS SOMEONE HAS LIVED THE MOST YEARS.... SOMEONE HAS LIVED THE MOST YEARS.

. . . .

51. CIRCLE THE WORD THAT MEANS IN THE DIRECTION OF HOME. . . . IN THE DIRECTION OF HOME.

Pace the items steadily, as on the previous page.

Page 12:

TURN TO PAGE 12.... NOW WE ARE GOING TO DO SOMETHING A LITTLE DIFFERENT. THE DIRECTIONS SAY: "READ THE STORY. SOMETIMES A WORD IS LEFT OUT. LOOK AT THE WORDS UNDER THE BLANK. CIRCLE THE WORD THAT FITS BEST IN THE BLANK."

LET'S DO THIS PAGE TOGETHER. THE FIRST STORY SAYS:

"MARY HELPS HER MOTHER AT HOME.
SHE SETS THE TABLE AND DRIES THE DISHES.
MARY IS A VERY ..BLANK.. GIRL."

YOU READ THE WORDS UNDER THE BLANK. CIRCLE THE WORD THAT A MAKES SENSE IN THE BLANK.

. . . .

LOOK AT STORY NUMBER 2:

"JOHN HAS BAD LUCK. HE LOST HIS LUNCH MONEY. HIS NEW TOY BROKE. JOHN IS VERY ..BLANK..

CIRCLE THE WORD THAT FITS BEST IN THE BLANK.

. . . .

LOOK AT STORY NUMBER 3:

"MARY PLAYED HARD ALL DAY. BY NIGHT TIME SHE FELT TIRED AND ..BLANK..

CIRCLE THE WORD THAT FITS BEST IN THE BLANK.

Pause 10-15 seconds between stories. Let fast readers go ahead on the page if they want to. Children are not required to write the word in the blank. Make sure that a choice is circled for each item.

NOW TURN TO PAGE 13..... THE DIRECTIONS SAY: "READ THE STORY. SOMETIMES A WORD IS LEFT OUT. LOOK AT THE WORDS UNDER THE BLANK. CIRCLE THE WORD THAT FITS BEST IN THE BLANK.

THIS WHOLE PAGE IS ONE STORY. YOU READ THE STORY. CIRCLE A WORD TO FILL EACH BLANK.

Do not read this story aloud. Circulate around the room to make sure the children are circling. As the children finish, say

WHEN YOU HAVE FINISHED, CLOSE YOUR BOOKLET. IF THERE WAS SOME PART THAT YOU DIDN'T GET TO FINISH BEFORE, GO BACK AND FINISH IT NOW.

Collect the booklets as the children finish. Make sure the full name is on the cover.

THAT'S ALL FOR TODAY! THANK YOU!

Changes for POSTTEST:

Change the opening speech to:

> GOOD MORNING BOYS AND GIRLS. YOU PROBABLY REMEMBER A COUPLE WEEKS AGO YOU DID SOME READING EXERCISES. WE WOULD LIKE YOU TO HELP US AGAIN, BY DOING SOME OF THE EXERCISES OVER AGAIN. SOME OF THEM MAY SEEM EASIER THIS TIME AND SOME MAY NOT. DON'T WORRY ABOUT WHAT YOU DID BEFORE. JUST THINK ABOUT THE BEST ANSWER FOR EACH QUESTION. IT IS IMPORTANT THAT YOU WORK CAREFULLY.
>
> NOW I WILL PASS OUT THE WORK BOOKLETS. ON THE FIRST PAGE, PRINT YOUR FULL NAME, BOTH YOUR FIRST NAME AND YOUR LAST NAME. DO NOT OPEN THE BOOKLET.

The test itself is given exactly the same way.

Make no secret of the fact that the test is the same. But encourage the children to do their best work this second time. Ask them to help us out, and stress that it is important that they work carefully, even though they've done it before.

APPENDIX C

THE SECOND GRADE ETU IN READING

EXPERIMENTAL TEACHING UNIT

SECOND GRADE

READING

Developed by

Teacher Education Division
Far West Laboratory for
Educational Research and Development
1855 Folsom Street
San Francisco, CA 94103

Introduction to the Unit

This Experimental Teaching Unit is intended to give students some practice in important reading skills. There are two sections to the unit, each of which deals with slightly different skills.

For each section the following things are included in this packet:

(1) a brief overview of the skill area
(2) a list of performance objectives for the students
(3) a set of sample instructional materials (you may use those included, select some from another source, or create your own)
(4) some suggestions on ways to use the materials and on other related activities.

Your students will be both pre-tested and post-tested on the objectives listed in each section. Individual student scores on the pre-test will be provided for you.

Please spend about 25 minutes each day on work related to these objectives. This means that a student working on unit activities should spend no more than about 25 minutes total during the day.

There are many different ways of organizing the materials and of relating one objective to another. Many exercises can be planned to cover more than one objective. If you wish, objectives from different areas can be included in the same lesson. We are interested in the variety of ways to teach these reading skills. You may teach as much of the unit to as many of your students as you wish, and in any manner you choose.

As much as possible, please keep track of what materials and activities you use to teach the unit. To help you do this, please follow these procedures:

(1) Each of the two sections in the ETU is composed of a set of instructional objectives.
    (a) For each section, select the objectives you plan to use.
    (b) Arrange the objectives in the order in which you plan to use them and place the appropriate number in the space provided. (You will use this number to identify each objective on your teaching record, so do this before you begin the unit.)
(2) Use the Daily Teaching Record, to keep track of the instructional objectives and the materials or activities you focus on each day.

At the end of the unit we would like to get information from you on questions like:

(1) What materials did you use (either from the packet or of your own devising)?
(2) In what order were objectives and materials used?
(3) Which materials/activities worked well and which less well?
(4) What was the reaction of the children to the unit?
(5) What procedures did you use for teaching different objectives?

We hope you, as teachers, will feel free to try out different approaches to teaching the unit.

Record Keeping

It is important to the study for us to find out how different people go about teaching this unit. We would like you to help by keeping records as you teach the unit. Record keeping is often time consuming, but we hope these procedures will be convenient and not add too much to the normal demands of preparation. Please do the following:

1. You have numbered the instructional objectives in the order in which you introduce them. Place the numbers on the lines to the left of the objectives. (Note: The fact that you number objectives consecutively does not mean that you have to complete work on one objective before moving to another.)

2. For each teaching day, record information about time and students taught. Use the form labeled "Time Record."

3. For each teaching day write a brief description of the day's activity. Use the "Daily Teaching Record" form. Please be sure you included the following things in your description:

    a. Objective covered;
    b. Materials used;
    c. Activities or ways of using materials.

   If you use materials or activities from the packet you can refer to them by the identification number. (Materials are identified by page, in the upper right hand corner. Activities are identified by the number to the left of the paragraph description.)

   You may fill out the "Daily Teaching Record" either before or after the actual lesson. If you fill it out before, please note any changes you made during the actual teaching, also record the general pupil reaction to the lesson. Use the spaces labeled:

   Changes while teaching
   Pupil response

   You can also use the section labeled "Additional Comments" to make comments about the lesson. If possible, please save a copy of any work sheets you make up.

C-4

NAME ____________________

DATES ____________________

TIME RECORD

	START	STOP	STUDENTS WORKED WITH*
DAY # 1			
DAY # 2			
DAY # 3			
DAY # 4			
DAY # 5			

	START	STOP	STUDENTS WORKED WITH*
DAY # 6			
DAY # 7			
DAY # 8			
DAY # 9			
DAY # 10			

---

* If you work with the entire class, write "entire class". If you work with a subset of the class, write the student's names.

C-6

NAME ______________________________

DAILY TEACHING RECORD

DAY _________________________

Objectives:

Materials/Activities:

Changes While Teaching:

Pupil Response:

Additional Comments:

FOLLOWING DIRECTIONS -- SEQUENCING

An important area of development at the beginning of second grade is the ability to read and follow directions. Being able to read directions allows the child to work more independently. At the same time, the child is learning something about the nature and purpose of reading: Words on paper are meaningful. They are used to communicate a message. One forceful example is a message to do something--a direction. Reading for this purpose is common in everyday life.

Directions range from simple, one-step procedures to more complex combinations of steps. Following more complex directions involves an understanding of sequence. Building on the child's understanding of actions and consequences in the real world, the child can come to recognize better the organization and sequence behind what he reads. This is true of both complex directions and narrative stories.

This section of the Unit deals, then, with following directions and with understanding and following a sequence of actions.

The specific performance objectives of this section are the following:

__________ The child can read and follow a sequence of 2 or 3 directions.

__________ The child can read and follow a simple, one sentence direction.

__________ The child can decide where to add a statement to a sequence.

__________ The child can choose a statement to fill a given place in a sequence.

__________ The child can decide which of several statements has been left out of a sequence.

__________ The child can number statements in sequential order.

__________ The child can make up a statement to fill in or complete a sequence.

C-8

FOLLOWING DIRECTIONS

1. Give one- and two-step directions orally to the children. Children respond by following the directions.

Example:

1. Make a ball on your paper and put a dot next to it.
2. Make an "X" on your paper and put a circle around it.
3. Put a dot at the bottom of your paper and put two lines under it.

2. Give children a set of written directions that will form a picture when followed correctly. Later meet again with the children and share their pictures. Are they all the same? Why? Why not? (See page 101 in directions.)

3. Ask a child to place a few items on a table like an eraser, chalk, pencil, box, book etc. Ask children to describe what they see so you could draw a picture without looking at the table. Do not look at the table, and draw on the board exactly what the children tell you. Is your picture the same as what is on the table? Why? Why not? Did you forget number, size or position words? Do the words "next to" tell you enough?

4. Give children a series of written directions. Ask them to read and follow the directions.

5. In a group situation ask children to demonstrate in some way the following words:

over	under	in	out	on
right	left	first	last	around
middle	large	small	outside	third
center	side	farthest	between	below

match nearest corner row behind
after pair group

6. Put the following directions on a separate piece of paper. Give one to each child playing the game. The child should act out the direction. See if the other children can guess his direction.

1) Feel your hair
2) Hop, skip then jump
3) Look at your feet
4) Give a book to someone
5) Cross your legs
6) Walk over to a table
7) Get something green
8) Hold up your left hand
9) Go under a table
10) Spell a word

7. Ask children to give step-by-step directions that they would use to make a peanut butter and jelly sandwich. Write these directions on the board. THEN - following each direction exactly make the sandwich. Did you use a knife? Did the directions say to use a knife? Did you use crunchy peanut butter? What kind of jelly? Did you cut the sandwich? etc.

8. Using several objects such as a pencil, large and small paper, book, eraser, yarn, chalk, box, etc, ask children to follow these directions:

1. Place the eraser in the center of the table.
2. Put the large paper on the right side of the eraser as you look at it.
3. Put the pencil under the large paper.
4. Put the book next to the large paper.
5. Put the small paper below the book.
6. Put the yarn around the pencil and large paper.
7. Put the chalk far from the book.
8. Put the box over the eraser.

9. Give children direction sheets of several directions with the first direction being: Read everything before doing anything. Let each child discover how far he proceeded before remembering the first direction. (See page 109.)

ACTIVITIES - SEQUENCE

10. Read a short story to the children or ask children to read the story. Discuss sequence of the story. What happened first, second, third etc. What might happen if the story did not end where it did? Could you add something to the story? Where would you add it?

11. Show the children a picture with action. Ask them to dictate a story about what is happening in the picture. What would happen first? etc. Write the story on the board as they dictate. When the story is finished, read it together. Did you forget an important part? If so, where would you put it? Do you think it happened in that order? Could it happen in another order?

12. Ask the children to dictate to you the sequence of a typical school day in their lives. What is the first thing they do? What is the last thing they do? Does everyone follow exactly the same sequence? Do some children watch T.V. before dinner and some after dinner? Suggest additional events and ask the children where they would fit in the sequence.

Have children dictate other stories that have a definite sequence. Some story titles are:

Seasons of the Year
How I Bake a Cake
Going to the Store
Christmas Day
When it Rains

13. Show children only the pictures of a story. Ask them to dictate a story to go with the order of pictures they saw.

14. Ask children to read a paragraph and number the following statements in the order that they happened in the story. (See materials page 152.)

15. Give children a set of pictures. Ask them to paste the pictures in the correct order. Paste the sentence that tells about the picture under the picture.

16. Give children a set of statements. Ask them to arrange the statements in order and paste them on their paper. Ask them to draw a picture for each statement. (See materials 150.)

17. Take the sentences children have written for a story and print them on separate sentence cards. About 6 sentences should be used. Give a child 3 of the 6 and ask him to put them in order. Point out a particular place in the sequence and ask him which of the remaining sentences would fit there. Or give him a sentence and ask him to fit it in.

18. Read part of a story to the children. Stop at an interesting part. Ask them to draw a picture about what would happen next and to write a sentence about their picture.

19. Have fun with the natural order of things around children. Ask them to:

    1. Line up shortest to tallest.
    2. Line up from very blond to black hair.
    3. Line up from short hair to long hair.
    4. Using mixed up word cards arrange the days of the week in sequence.
    5. Using mixed up word cards arrange the months of the year.
    6. Discuss oldest and youngest in their family. Who was born first, second etc.
    7. Using several objects arrange them in order of size.

20. Ask the children to find the pattern in a sequence and write what would come next. (See materials page 151.)

21. String beads according to sequence of size or color. Line up buttons according to sequence of size or color.

22. Take two or three sets of directions or stories. Print each sentence of each set on a separate card. Mix up the sentences and ask the child to sort them into sets according to which sentences go together. Then ask the child to order the sentences within each set.

23. Take a set of sentences which go together in a sequence. Leave something out of the sequence. Ask the child to write a sentence to fill in the story. (See materials page 155.)

1. Draw a happy fat clown.

2. Draw five buttons on the suit.
   Color the buttons blue.

3. Draw a tall pointed hat for your clown.
   Put the hat on his head and color it yellow.

4. Draw three red balloons coming from the
   right hand of your clown.

5. Color two blue eyes, one black nose and
   two orange ears.

6. Draw something funny on the left shoe
   of your clown.

7. Write your name on the clown.

Below are some words.
Draw a box around something you eat.
Draw a circle around something you wear.

dress eggs cake pie

ham skirt hat blouse

Draw a circle around every word four letters long.

listen magic fire paint wood

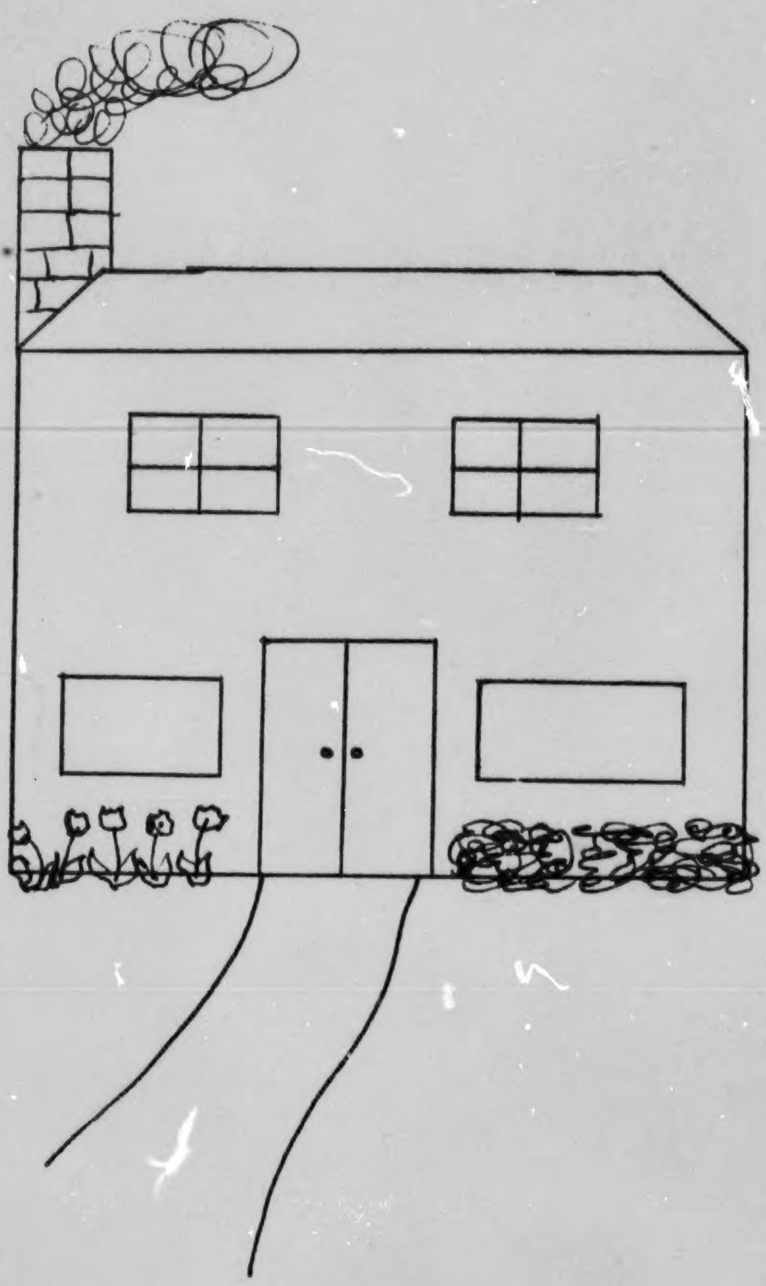
Look at the picture.
Do what the sentences tell you to do.

1. Put a ✓ on the door.

2. Put a red ○ around the house.

3. Put an X over the smoke.

4. Put two green lines under the house but inside the circle.



Below draw a picture of a yellow duck in a pond
with a big red barn and six cows next to it.

1. Circle the word that tells what a boy could do.

   big brown walk tree bird

2. Circle the word that shows action taking place now.

   drank wrote walked bring picked

3. Circle the third number.

   5 9 6 3 2

4. Circle the next to the last number.

   6 3 2 9 1

5. Circle the number that is closest to 5.

1 0 4 8

6. Circle the largest number.

6 3 7 1

7. Circle the word that does not belong.

bird dog horse goat

8. Circle the word between two numbers.

three boat six car

1. Draw a circle next to number one and color it red.
2. Write the letter A next to the number two on your sheet. Draw a box around it.
3. Write your name next to the number three and underline it.
4. Draw a box next to number four and write the number 4 inside.
5. Write your first name twice and your last name once next to number five.
6. Draw a line next to number six. Put an "X" above the line. Put a star below the line.
7. Next to number seven, draw a circle with an arrow through it.
8. Beside number eight, draw a large letter M. Put a line under the letter.

Name ______________________________

1.	5.
2.	6.
3.	7.
4.	8.

Directions:

1. Write your name on your paper.
2. Draw a box around D. Draw a box around B. Draw a line from one box to the other.
3. Write the number nine between B and C.
4. Write the number five between E and F. Draw a line from H to 5 to I, and back to H. This will look like a triangle.
5. Put a star inside the triangle.
6. Draw a line from G to C, going across E.

Name ______________________________

A B C

D E F

G H I

Three Minute Time Test
Can You Follow Directions?

1. Read everything before doing anything.

2. Put your name in the upper right hand corner of this paper.

3. Circle the word "name" in sentence two.

4. Draw five squares at the top of this paper.

5. Put an "X" in each square. Put a circle around each square.

6. Write "Yes", "Yes", "Yes" after the question "Can You Follow Directions?"

7. On the back of this paper, add 6 + 3.

8. Put a circle around your answer.

9. Now that you have finished reading carefully do only directions one and two.

☐ Dad went to work.

☐ Dad got up at 7 o'clock.

☐ He had something to eat.

☐ She helped her mother put the dishes away.

☐ Kim set the table.

☐ Kim washed the dishes.

☐ Her family talked while eating.

☐ We ate hotdogs and beans.
☐ It was late when we got home.
☐ We all went on a picnic.
☐ Our dog was still barking when we went to sleep.

☐ They loved to go on all the rides.
☐ Last week Sue and her sister went to the fair.
☐ The roller-coaster ride was the only scary one.

What comes next?

1. □ • □ • □
2. △ ○ ▭ △
3. 2 4 6 8
4. D E F G
5. S s T t U
6. o | o || o ||| o
7. ▷ ▷ ▷ ▷ • ▷ ▷ ▷ • ▷ ▷
8. boy girl boy girl

Read the story.

Sam's mom asked, "Will you please get some milk at the store? Here is some money. Put it in your pocket.

Sam put the money in his pocket and started out the door.

On the way to the store, Sam mailed a letter to his pal Ted. Then he went to the store.

He found the milk and paid his money.

When he got home, his mom thanked him. "You have been a good helper today."

Look at all the lines below.

Find the line that tells what Sam did first.

Put a number 1 in front of that line.

Put a number 2 in front of what Sam did next.

Number the other lines this way.

______ Sam found the milk.

______ Sam went home.

______ Sam's mom asked him to go to the store.

______ Sam mailed a letter to his pal.

______ Sam put the money in his pocket.

______ Sam's mom thanked him.

Read the story below:

1. Bill is getting ready for bed.
2.
3. He puts on his pajamas.
4. Then, Bill climbs into bed.

One line of the story is missing. Read the lines below. Put an "X" by the line that goes best in the story.

☐ He takes off his clothes.

☐ He pulls up the covers.

☐ He plays a game with his brother.

Read the directions below:

1. To make a mask get a paper bag.
2. Draw a face on the bag.
3. Cut holes for your eyes and mouth.
4.

One of the directions is missing. Read the lines below. Put an "X" by the missing direction.

☐ Get the scissors.

☐ Paste ears on the sides of the bag.

☐ Look at pictures of masks.

Read the sentences. Part of the story is left out. Write a sentence to fill in the story.

1. Mary and her mother made cookies.
2. Mary helped mix the dough.
3. ______________________________
4. They ate the warm cookies.

Read the sentences. Part of the story is left out. Write a sentence to fill in the story.

1. One hot day Billy and his friends went swimming.
2. They rode to the swimming pool.
3. They put on their swimming suits.
4. ______________________________.

Read the story.

One day the class went to the zoo.

____

They lined up to go through the gate and into the zoo.

____

Then they went to look at the monkeys.

Now read the sentences in the two boxes. They go somewhere in the story. Write the sentences where they belong in the story.

The first thing they saw was a tiger.

They rode to the zoo in a bus.

Read the story.

Mary planted some seeds to make a garden.

____

At last the tiny plants came up through the ground.

____

Mary watched the flowers grow tall.

____

Now read the sentence in the box. It goes somewhere in the story. Write the sentence where it belongs in the story.

Mary watered the ground so the seeds would grow.

Now make up sentences to fill in the rest of the story.

_____ His sister saw the books.

_____ She ran to the door and shouted, "Come back Jim."

_____ Jim did not take his books when he left for school.

_____ When the birthday came, Ann gave her mother the picture.

_____ Ann made a picture for her mother's birthday.

_____ Ann found a place to hide it.

_____ Her mother liked the picture.

WORD STRUCTURE

One important component in skilled reading is the ability to recognize the structure of words. Knowledge of word structure can help the reader to decode long words efficiently.

One way for a child to begin to decode a long word is to look for familiar pieces within the word. It is important that the component pieces he chooses correspond with any meaningful linguistic elements in the word. In this way the process of decoding divides into stages, each of which gives the child a familiar, meaningful element which contributes to the meaning of the total word. For instance, familiar words can be combined to form a compound word. Or a familiar root word can be expanded into many related forms by the addition of a prefix or suffix. These prefixes and suffixes are themselves meaningful units. They modify the meaning of the root word in a predictable way. By knowing the meanings of component pieces of a word, the child can unlock the meaning of many new words.

For instance, a child trying to decode the word farmer should see the component pieces farm and er. By working with these pieces, he can combine the meanings of "farm" and "one who" to figure out the meaning of the word. And he can transfer the meaning of "-er" as "one who" to figure out other words. A child who sounds out in sound syllables like "far" and "mer" has no clue to the meaning (in fact he may be misled), and he has no meaning units to transfer to other words.

The addition of prefixes and suffixes sometimes necessitates a spelling change in the root word. This unit avoids such words and deals only with regular forms, where the root word is unchanged.

To summarize the three main elements of this section on word structure: (1) the child should learn to recognize a familiar word when it is a meaningful part of a longer word, (2) the child should learn the meanings of some common prefixes and suffixes, and how they change the meaning and form class (part of speech) of the base word in predictable ways, (3) the child should learn to use the correct word form in the context of a sentence.

The specific performance objectives of this section are the following:

The child can recognize a base word:

____ with a prefix added

____ with a suffix added

____ with both a prefix and a suffix added

____ The child can recognize the two words within a compound word.

____ The child can form a compound word from two familiar words.

____ The child can choose the correct form of a word to fit in the context of a sentence.

The child knows the meaning of some common prefixes, and can:

____ select the appropriate form to match a definition

____ form a word by adding the appropriate prefix

The child knows the meaning of some common suffixes, and can:

____ select the appropriate form to match a definition

____ form a word by adding the appropriate suffix

Prefixes and Suffixes

Grammatical Endings:

-s	Third person singular present (John walks)
-ed	Past (John walked)
-ing	With auxiliary verbs (John is walking)

Comparatives:

-er	More (faster)
-est	Most (fastest)

Other Suffixes:

-er	One who (teacher)
-ful	Filled with, in a state of (painful, playful)
-less	Without (homeless)
-ly	Tells how something is done--adverb (slowly) Describes a state--adjective (friendly)
-y	Describes a state (windy)
-ward	In the direction of (westward)

Prefixes:

un-	Not (untie, unable)
re-	Again (rewrite)
bi-	Two (bicycle)
tri-	Three (tricycle)

COMPOUND WORDS

31. Pass out word cards to children. Each child may have more than one word. Ask one child to put a word in the pocket chart. The child who has a word to go with the word in the chart, so as to make a compound word may add his word to the chart.

Suggested word cards:

milk
man
gold
fish
drive
way

fire
truck
base
ball
home
made

back
yard
side
walk
some
where

pop
corn
door
bell
pan
cake

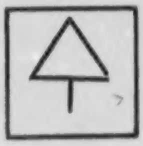
32. Give children a compound word with which they are unfamiliar. Ask them to write the word on their paper and draw a picture of what they think the word means.

Suggested word cards:

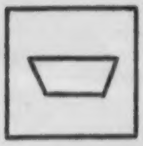
armchair blacksmith backlog

33. Ask children to illustrate the following words and then write the two words together and illustrate the new word.

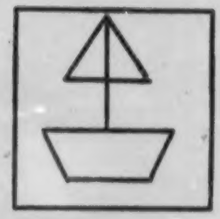
Sail



Boat



Sailboat



34. Concentration

Match words so as to make a compound word. Child with most pairs is the winner.

35. Puzzles

Using a puzzle with a backboard write one part of a compound word on the puzzle piece and write the other part of the compound word in the correct place on the backboard. Child must say the compound word when he places the puzzle piece in its correct position.

36. Tic Tac Toe

Child draws from a deck of cards a compound word. He must say the two words in the compound word before placing his "X" or "O".

37. Dominoes

Make dominoes out of paper or cardboard. Children draw 5 dominoes.

He matches dominoe with another dominoe that would make a compound word. When he cannot make a match he must draw another dominoe. First child to get rid of all his dominoes is the winner.

Example of dominoes:

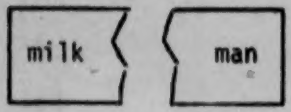
bed	ball
man	room
milk	fire

38. Old Maid

Pack of 12 cards plus one old maid. Deal out all the cards. Child must make compound words.

39. Puzzles

Put several compound words on a sentence strip. Cut strip between the two words. Example:



Child matches words to make a compound word.

40. Write a compound word on the board. Ask children to come up to the board and write the two words contained in the compound beside it.

41. Have children read sentences with the compound words underlined in them. Ask children to write the two words which make up the underlined word beside the sentence. You also might ask children to substitute other compounds for each sentence.

42. Write 2 lists of words on the board, and ask children to draw lines between any pair of words which form a compound word.

43. Ask children to write compound words in appropriate sentences, given several alternatives. They could also match the words to their proper sentences. (See page 160 in materials.)

44. Pick a word such as "man", and see how many words can be attached to it to form compound words, e.g. postman, policeman, fireman, fisherman.

45. Have the children find a compound word in a sentence and underline it or draw circles around the two parts of the word. (See page 163 in materials.)

46. Compound words which might be used:

Storekeeper
loudspeaker
shotgun
dishpan
daylight
newspaper
darkroom
toothache
spaceman
farmhouse
storeroom
flashlight
snowball
toybox
underground
starfish
afternoon
bluebird
housework
lighthouse
airport

46. (cont'd)

backyard
downhill
grandfather
hillside
streetcar
bookstore
paperback
bedroom
overcoat
overcast
driveway
policeman
sunflower
cookbook
wastebasket
sandbox
homemade
blueberries
outdoors
bedtime
raindrop
fisherman

PREFIXES AND SUFFIXES

50. Put up on the board a group of words which are different forms based on the same root. Use words familiar to the children. Talk about what the different words mean. Help the children to discover that they all have something to do with the root word. One possible root word is sleep (sleeper, sleeping, sleepy).

51. Write a group of words with the same prefix or suffix on the board. Ask children to use each in a sentence. Help them to discover what the prefix or suffix means.

52. Use a matching task to match base words to their inflected forms. (See page 174 in materials.)

53. Have children fill in a sentence blank by choosing from different forms of the base word. (See pages 175, 177, 179, 186 in materials.)

54 From either a list of words, or words embedded in sentences, have children circle or write the root part of inflected-form words.

55. After a prefix or suffix has been introduced and the meaning defined, ask children to think of as many root words as they can that could use that prefix or suffix. Or give them a list of root words and ask them when the prefix or suffix would be appropriate. Could you "redo"? or "rebuild"? or "resit"? or "rebig"?

56. Using any story the children can read, have them pick out all the inflected-form words and then circle the roots of those words.

57. Differentiate the -er and -est endings, using some of the approaches outlined above. (See pages 185, 186.)

58. Differentiate the verb + -er words (e.g. singer) and the adjective + -er words (e.g. thicker), using some of the approaches above.

59. Give kids cards with different forms of root words. Put a root word on a pocketchart, and ask anybody with a form of that word to place it in the pocketchart.

60. Start with a familiar root word and ask the children to add a prefix or suffix to it to make a new word. How many different forms can they think of?

Examples: play
play
player
playful
replay

The children may think up combinations which are "nonsense" but can be interpreted from the pieces. What would it mean to be "playless"?

This exercise could also include compound words: playmate, playpen.

61. Give the child a root word and a definition. Ask him to choose the form of the word which fits that definition. Or ask him which prefix or suffix is needed.

62. Ask the children to write two stories illustrating different forms of a word, for example, afraid-unafraid, careful-careless, useful-useless, painful-painless, kind-unkind.

63. For other suggestions, see activities under Compound Words.

The man who brings the milk is the ______________.

A little house for playing is a ________________.

When it is cold, we put on coats to go __________.

The place beside the barn is the ________________.

playhouse

barnyard

milkman

outdoors

Draw a line to match up the two parts of a compound word.
Then write the word in the sentence where it belongs.

boat
road
pop
over

side
man
alls
corn

I can hear my mother pop the ______________________________.

We had a picnic at a table by the _________________________.

The man in the big blue boat is a ________________________.

Jack had on ___________________ at his uncle's farm.

Draw circles around the two parts of each compound word.
Write each word in the sentence where it belongs.

Peter was playing a game on the ____________________.

Children are at work in the ____________________.

Bob will bring his new ____________________.

The man in the red truck is a ____________________.

schoolhouse

fireman

sidewalk

football

A. Bill heard footsteps in the old house.

B. The children went to the school playground.

C. There were animal tracks around the scarecrow.

D. Father rang the doorbell.

E. The mailman brings the mail to our house.

F. Mary filled the goldfish bowl with water.

G. Mr. Jones sat in the doorway of his house.

H. The birds lived in a birdhouse.

class him boy side bag

cow__________

out__________

__________self

bean__________

__________room

____

____

__________fish

mail__________

__________yard

__________man

sail__________

Form new words by adding the suffixes -s, -ed, and -ing.

	-s	-ed	-ing
play			
jump			
pick			
clean			
help			
cook			

Write the root word for each of the following words.

started ____________

lifts ____________

washed ____________

picked ____________

spelling ____________

caps ____________

dressed ____________

opening ____________

makes ____________

cleaned ____________

burns ____________

stacked ____________

cooking ____________

hats ____________

Write the root word.

farms ______________ jumping ______________

helping ______________ wished ______________

laughed ______________ picnics ______________

telling ______________ trees ______________

boys ______________ wanted ______________

Choose the word to fill the blank. Write the word in the blank.

1. The boy was ________________ him.
   (help, helping)

2. Tom ________________ at the clown.
   (laughing, laughed)

3. They were having a ________________.
   (picnic, picnics)

4. Billy ________________ a new bike last year.
   (want, wanted)

Read the sentence. Look at the underlined word.
Write the root word on the line under the sentence.

1. Ann was surprised when the balloon popped.

____

2. The baby was drinking milk all by himself.

____

3. The plants are growing fast under the hot summer sun.

____

4. When a man brings the lions food they stop roaring.

____

5. Tom sings a funny song.

____

6. The dog followed the boy to the corner this morning.

____

Read the story. Underline all the words which are forms of the word jump.

Jill is a little girl. She likes to jump.
On the playground Jill jumps with a jump rope.
After school she is always running and jumping.
One day she jumped all the way across the sidewalk.
Her mother calls her a jumping-jack.

One day Jill and her friend had a jumping
contest. Whoever makes the longest jump wins.
Jill jumped first. She sailed through the air.
Her friend tried hard to jump as far as Jill.
But Jill was the winner. She was the best jumper.

Draw a line to connect the root word with the word that comes from it.

toss
want
seat
pick
help
spill
start
sleep
eat

picks
sleeping
starts
tossed
wants
eating
spilled
seated
helping

The ending ed means something happened in the past.
Practice on these words.

walk - walked

Now I __________ down the steps.

Before I ____________ up the steps.

play - played

Today I __________________ alone.

Yesterday I __________________ with Bill.

call - called

Last night Jan ___________________ me up.

Now I _________________ her up.

watch - watched

Last time we __________________ football.

This time we __________________ baseball.

helps - helped

Ann ______________ her mother yesterday.

She ______________ her today, too.

1. A person who sings is called a ____________________.

2. A person who prints books is called a ____________________.

3. A man who paints pictures is called a ____________________.

4. A man who builds houses is called a ____________________.

printer

singer

builder

painter

1. A man who knows how to fly an airplane in the sky is a ________________________.

   flyer player singer

2. If you try to catch a ball and you do, you are a good ____________________.

   painter catcher keeper

3. A man who grows corn and other things on a farm is a _________________.

   flyer farmer reader

4. A person who plays football is a football _______________.

   playing replay player

5. When you go camping and sleep outdoors, you are a _________________.

   camper camping campy

6. Something that warms you up is a __________________.

   heating heats heater

7. Someone who cuts the grass and trims bushes is a _________________.

   camper gardener rancher

Put ly after each word to make a new word. Write the new word.

soft ______________

sad ______________

close ______________

slow ______________

friend ______________

warm ______________

brave ______________

hard ______________

bold ______________

week ______________

Fill in the missing word in each sentence.

1. Curly was a __________ monkey.

   brave   bravely

2. Robert knocked ___________ at the door.

   soft   softly

3. The airplane was ___________ to the mountain.

   close   closely

4. The girl walked ___________ down the street.

   sad   sadly

5. Talk ___________ or someone may hear you.

   soft   softly

6. The covers felt __________ to his body.

   warm   warmly

7. Mrs. Black is a ____________ lady.

   friend   friendly

Read each sentence. Study the underlined word. Then write it below the right heading at the bottom of this page. The first one is done for you.

1. Bill remembered the truth sadly.
2. Mr. Green gave us a friendly smile.
3. He got ready slowly, then went to meet his friends.
4. The box had a lovely, blue wrapping.
5. The sun shines brightly on most days in July.
6. Nina danced quickly around the room.
7. He sat quietly and listened to my story.

How Something Was Done	How Something Looked
sadly	______________
______________	______________
______________	______________
______________	______________

Read each sentence. Chose a word from the box that will fill the blank when you add less to it. Then write the word in the right blank.

help
care
home
speech

1. If you have no home, you are ________________.

2. ________________ people do not take care of things.

3. Without her mother to help her make dinner, Mary is ________________.

4. Henry was so ________________ with surprise, he did not say a thing.

C

Read each sentence. Study the underlined word. Then write it below the right heading at the bottom of this page. The first one is done for you.

1. Bill remembered the truth sadly.
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3. He got ready slowly, then went to meet his friends.
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How Something Was Done	How Something Looked
sadly	

Read each sentence. Chose a word from the box that will fill the blank when you add less to it. Then write the word in the right blank.

help
care
home
speech

1. If you have no home, you are ________________.

2. ________________ people do not take care of things.

3. Without her mother to help her make dinner, Mary is

   ________________.

4. Henry was so ________________ with surprise, he did not say a thing.

Use the prefix un to make a new word from each word below. Write the new word.

lock ____________________

cover ___________________

able ____________________

fair ____________________

kind ____________________

seen ____________________

lucky ___________________

even ____________________

Write each word by its meaning.

1. not kind ______________________
2. not able ______________________
3. not lucky _____________________
4. not seen ______________________
5. not even ______________________
6. not fair ______________________
7. the opposite of cover _________________________
8. the opposite of lock __________________________

un--

tie
lucky
lock
painted
wanted
opened

1. The window is not open, so it is ________________.

2. I can't come in until you ______________ the door.

3. Something no one wants is ______________.

4. The rope is _______________.

5. The ________________ house had no paint on it.

6. When I have no luck, I am _________________.

Add the prefix re to each word. Write the new word.

read ______________ fill ______________

pay ______________ write ______________

match ______________ run ______________

Read the sentence. Fill the blank with a word from the list above.

1. Since we must pay back money to the bank, then we must ______________ them.
2. If you did not read all of the story the first time, you must ______________ it.
3. Mary's glass of milk is empty, so she can ______________ it.
4. If the paper is not neat, then you have to ______________ it.
5. The fighter who lost the boxing match asked for a ______________.
6. When a television show is run over again it is called a ______________.

Adding er and est.

	more than before	most of all
hard		
slow		
old		
long		
dark		
soft		
small		

Read the sentence. Add er or est to fill in the blank.

1. A cat's fur is the soft_____ thing in the world.

2. Our car goes slow______ than your car.

3. It is dark_______ at night than in the day.

4. Mary is the old______ girl in the class.

5. A dog is small______ than a cow.

6. Jim tried the hard______ to win the race.

Learning about bi and tri.

A bicycle has ____________ wheels.

A tricycle has _____________ wheels.

bi means _______________

tri means _______________

A biped is an animal with ____________ feet.

A biplane has _________________ sets of wings.

A club that meets biweekly meets every _____________ weeks.

A triangle has _______________ corners.

A tricolored flag has __________________ colors.

Triplets are ________________ children born at the same time.

Using the suffix ward.

ward means "in the direction of"

Add ward to these words.

west westward

home ______________

sea ______________

in ______________

out ______________

up ______________

back ______________

Read each sentence. Choose a word from the box that will fill the blank when you add ful to it. Then write the word in the right blank.

cheer
rest
pain
truth
hope
help

1. If your little brother breaks his arm, it may be ____________________.
2. A person who tells the truth is called ____________________.
3. The happy children sang a ____________________ song.
4. When you want to know the meaning of a word, a dictionary is a ________________ book to have.
5. Sunday was quiet and ________________.
6. John was ________________ that his team would win.

Read the sentence. Look at the underlined word. Write the root word on the line below.

1. It was a chilly day, so Bob wore a jacket.

____

2. Jim made a face when he tasted the salty soup.

____

3. Our feet got wet on the rainy day.

____

4. The car bounced on the bumpy road.

____

5. It was such a windy day that our hats blew off.

____

6. Sue is not very neat. Her room is messy.

____

Read the story. Circle a word to fill each blank.

One day John ____________ out the window. He saw two
(looking, looked)

men ________________ out of a truck. John ran outside.
(gets, getting)

He __________________ the men what they were ________________.
(asking, asks, asked) (do, did, doing)

"We are going to ______________ the street," they said.
(painter, paint)

One man got a cart. He __________________ it across the
(pushes, pushing, pushed)

street. The cart made a white line as it moved. The man

said, "This line _____________________ you where to walk."
(showing, shows, showed)

APPENDIX D

TEST GIVEN AS PRETEST AND POST TEST FOR THE SECOND GRADE ETU IN MATHEMATICS

Measurement

Name ____
First   Last

Teacher's Name ______________________________________

School ____

General Directions

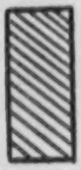
In this booklet most of the time you will circle the answer you choose. The work will be read to you, one problem at a time so that you can work the problem after it is read.

Here are some sample problems for us to work together.

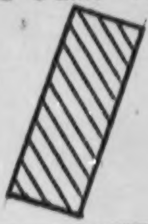
1A. Circle "YES" if the sentence is correct. Circle "NO" if the sentence is wrong.

Rod A and Rod B are the same length.

A.



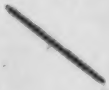
B.



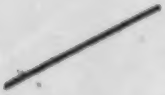
YES NO

1B. Line A is shorter than line B.

A.



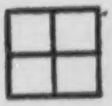
B.



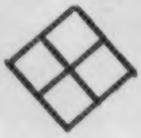
YES NO

1C. The area of Figure A is
greater than
smaller than
the same as
the area of Figure B.

A.



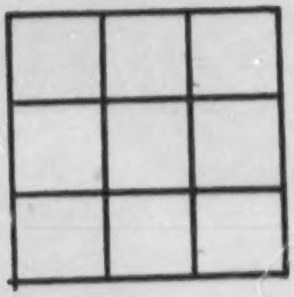
B.



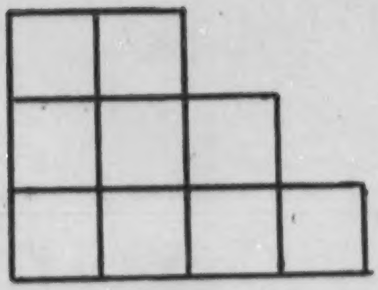
Circle the answer.

1. The area of Figure A is
greater than
smaller than
the same as
the area of Figure B.

A.



B.



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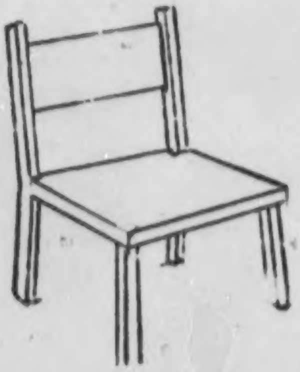
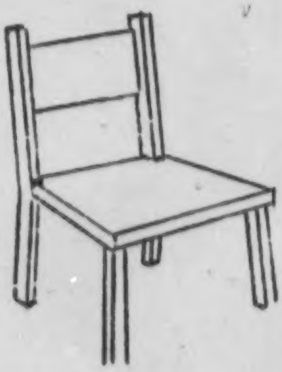
2. The back of chair A is
wider than
narrower than
the same as
the back of chair B.

A.



B



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3. Circle the metric unit you would use to measure the weight of a can of tuna.

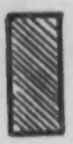
gram

litre

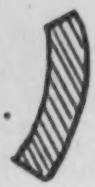
metre

4. Circle the figure that is both the longest and the thickest.

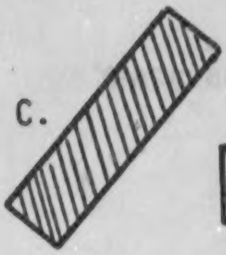
A.



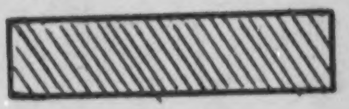
B.



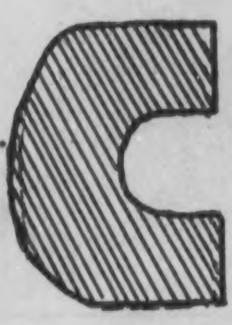
C.



D.



E.



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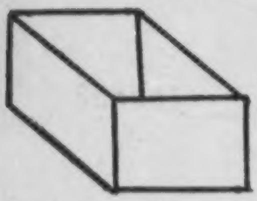
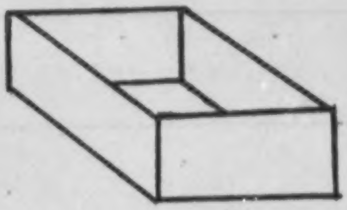
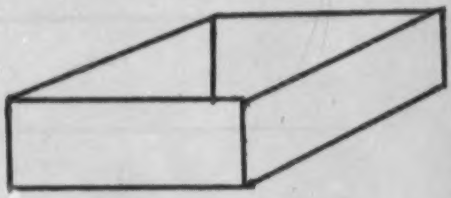
5. Circle the box that is both the deepest and the narrowest.



A.

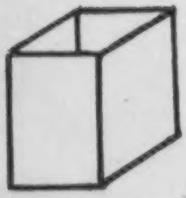


B.



C.

D.



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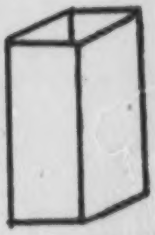

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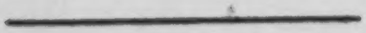
6. Circle the metric unit you would use to measure the amount of liquid in a carton of milk.

centimetre litre metre

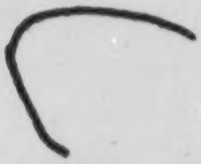
7. Circle "YES" if the sentence is correct. Circle "NO" if the sentence is wrong.

Line A is longer than Line B.

A.



B.



YES NO

---

8. Look at the person giving the test. After he/she asks you a question, circle YES or NO.

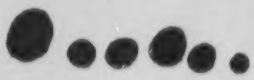
I have more clay now than I had before.

YES NO

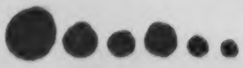
---

9. Circle the set that goes from biggest to smallest.

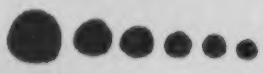
A



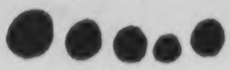
B



C.



D.



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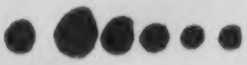
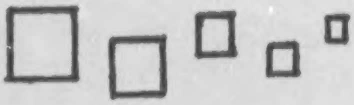
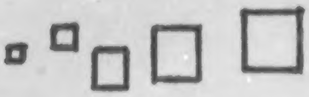


10. Circle the set that does not go from smallest to largest, or largest to smallest.

A.


B.


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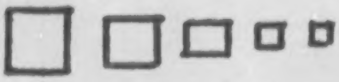

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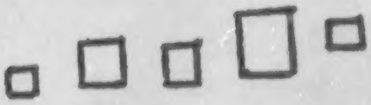
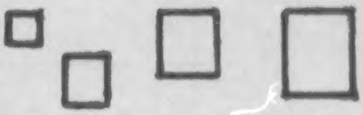


E.


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11. If you tried to find out how much water is in a bucket, which could you use? Circle the answers. More than one answer may be correct.

A. a bottle

B. a wooden block

C. a cup

D. a table

E. a clock

---

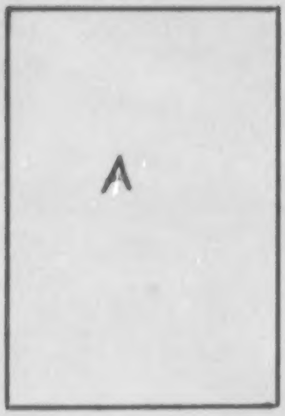
12. Circle the answer.

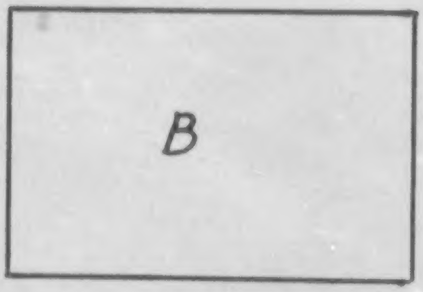
Centimetres are units to measure:

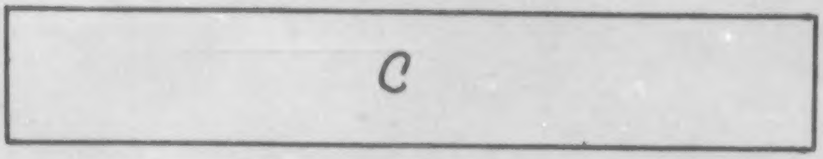
A. how much a pack of gum would cost.
B. how much a book weighs.
C. how long your foot is.
D. how much time you spend on the playground.
E. none of these.

13. Circle "YES" if the sentence is correct. Circle "NO" if the sentence is wrong.

If you used your squares to cover Figures A, B, and C, Figure C would be covered with the most squares.





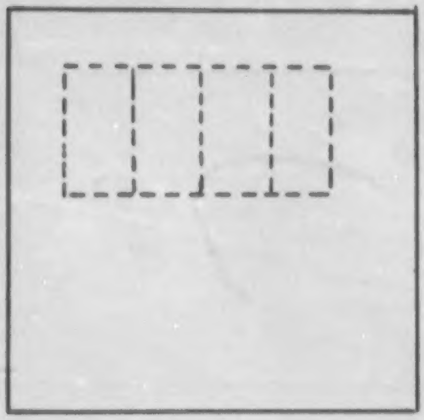


YES NO

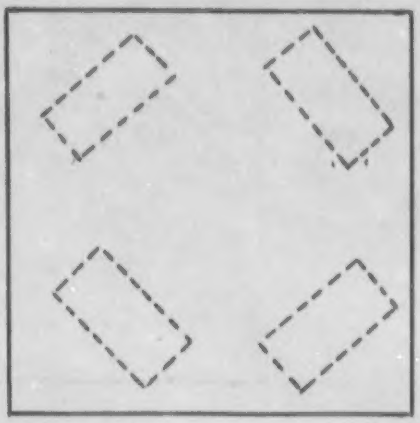
14. Circle "YES" if the sentence is correct. Circle "NO" if the sentence is wrong.

If you cut out around the dotted lines, you will have more paper left in Figure A.

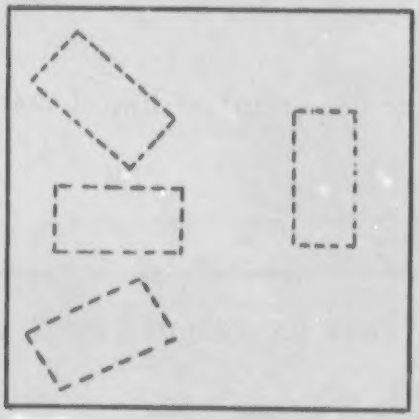
A



B



C



YES NO

15. Look at the person who is giving the test. After he/she asks you a question, circle "YES" or "NO".

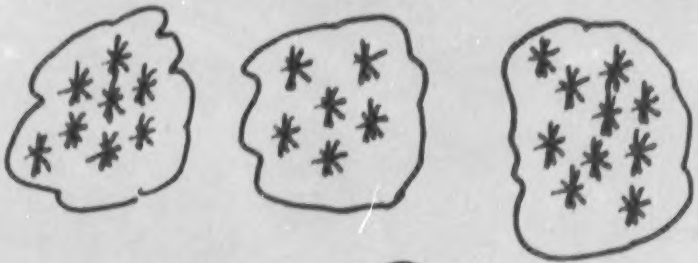
Both of these containers hold the same amount of water.

YES NO

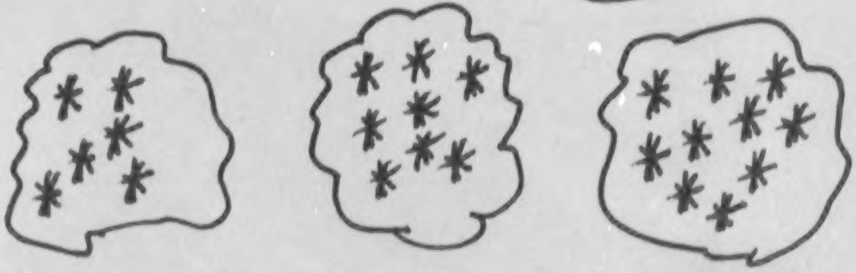
---

16. Circle the sets of stars that go from smallest to largest.

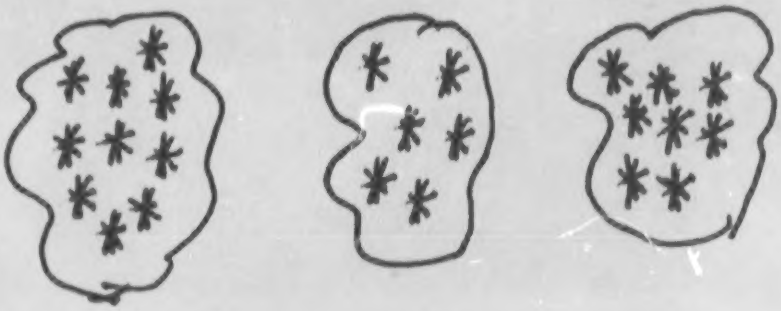
A.



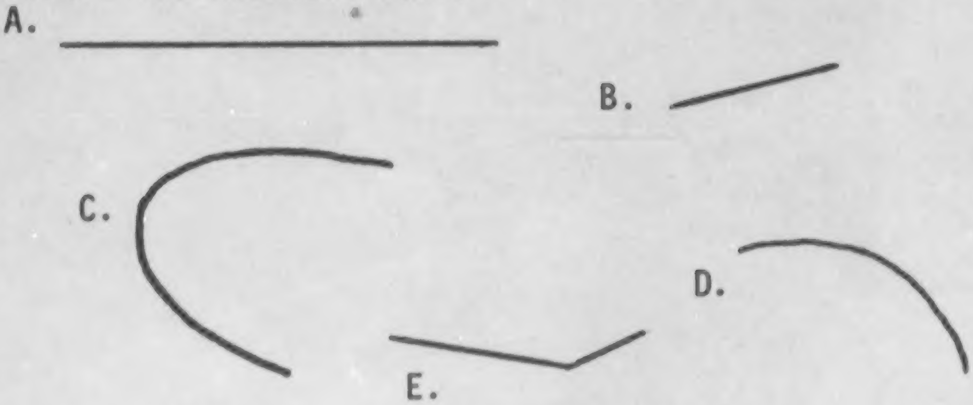
B.



C.



17. Circle the shortest line.



18. Put an "X" on the longest line.

19. If you were to put the lines above from longest to shortest, how would they go?

Write the letters to show what you would do.

1st line ____ (longest line)

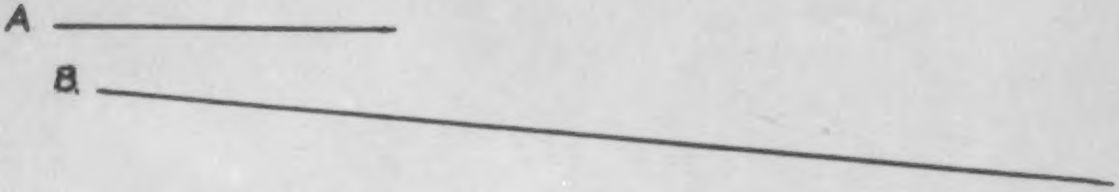
2nd line ____

3rd line ____

4th line ____

5th line ____ (shortest line)

20. Circle the line that is shorter.



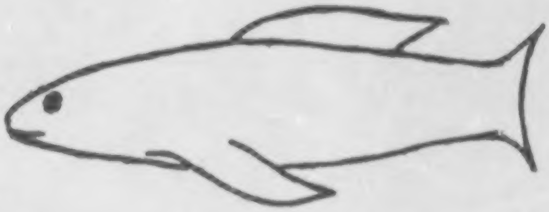
21. How much shorter? Use your string to find out. Circle the answer.

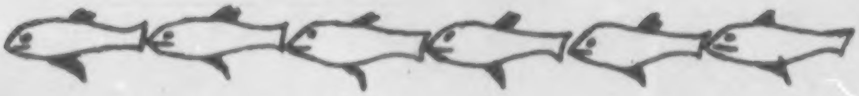
1 string 2 strings 3 strings

4 strings 5 strings

---

22. How many little fish in a line are as long as the big fish?



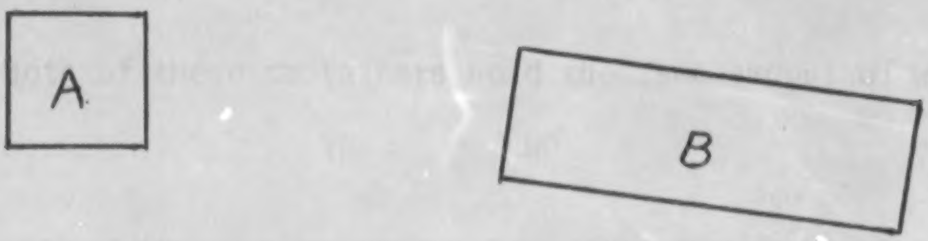


Circle the answer.

2 fish 3 fish 4 fish 5 fish 6 fish

23. Use your squares to find out:

How many more squares are there in Figure B than Figure A?



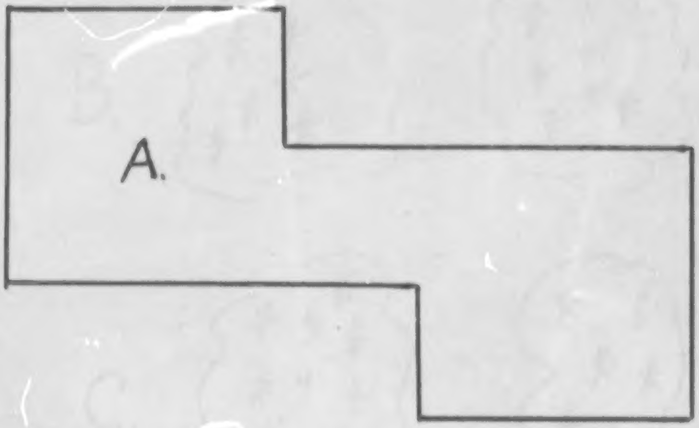
Circle the answer.

1 square 2 squares 3 squares

4 squares 5 squares

---

24. Using your squares, measure the area of Figure A to the nearest square.



Circle the answer.

6 squares 7 squares 8 squares

9 squares 10 squares

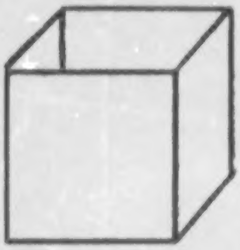
25. Circle the answer.

Litres are used to measure:

A. how tall the teacher is.
B. how long your arm is.
C. how heavy 5 pennies are.
D. how much water is in a dishpan.
E. none of these

---

26. If this were a real box,



Circle all the things you could measure on the box.

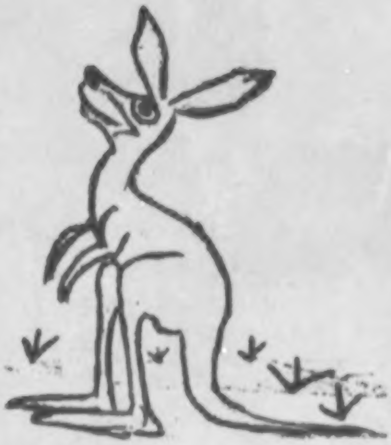
A. What the box is made of.

B. How deep the box is.

C. What color the box is.

D. The distance around the box.

27. Here is a picture of a kangaroo.



Circle all the things you could measure about this kangaroo.

A. How long the kangaroo is.

B. What color his eyes are.

C. How mean the kangaroo is.

D. How long his tail is.

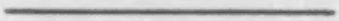
---

28. Circle the answer.

Grams are used to measure:

A. how long the playground is.
B. how much 3 beans weigh.
C. how many blocks fit into a box.
D. how wide a book is.
E. none of these

29. Using your centimetre ruler, measure the following line to the nearest centimetre.

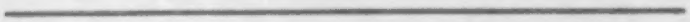


Circle the answer.

4 centimetres 5 centimetres 6 centimetres

7 centimetres 8 centimetres

30. Use the side of your squares and your short piece of string to measure this line.



How long is this line? Circle the answer.

A. 6 squares, or 1 piece of string

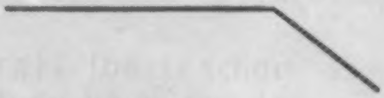
B. 5 squares, or 2 pieces of string

C. 4 squares, or 3 pieces of string

31. Circle the metric unit you would use to measure the width of your fingernail.

centimetre litre gram

32. Use a centimetre ruler. Measure this line segment to the nearest centimetre.



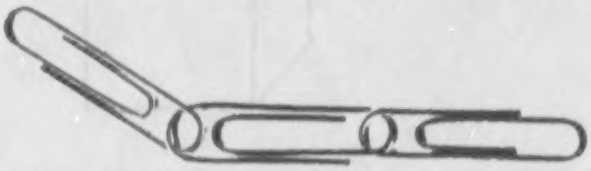
Circle the answer.

5 centimetres 6 centimetres 7 centimetres

8 centimetres 9 centimetres

---

33. How long is the chain of paper clips to the nearest centimetre.

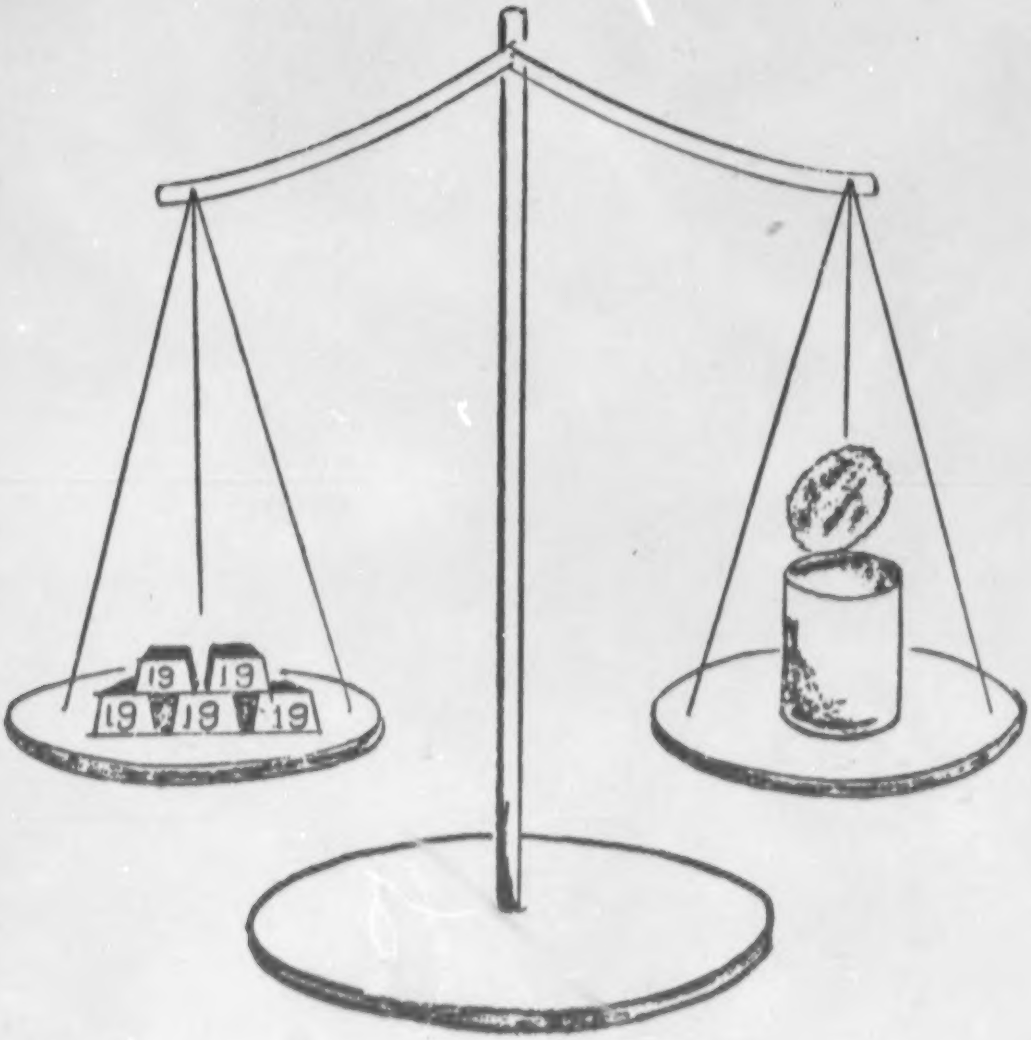


Circle the answer.

7 centimetres 8 centimetres 9 centimetres

10 centimetres 11 centimetres

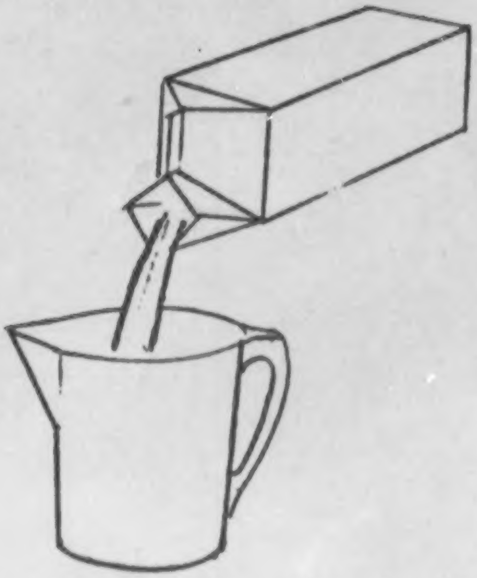
34. Look at this balance scale.



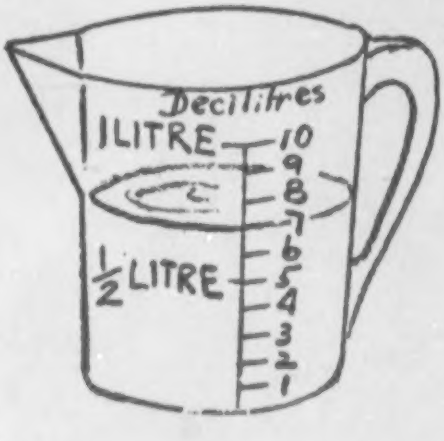
How many grams does the can weigh? Circle your answer.

2 grams 3 grams 4 grams 5 grams 6 grams

35. Suppose you pour all the milk from a carton into a litre measure.



How much milk was in the milk carton? Circle the answer.


Decilitres
1LITRE
10
9
8
7
6
½ LITRE
5
4
3
2
1

4 decilitres 5 decilitres 7 decilitres

8 decilitres 1 litre

APPENDIX E

TESTERS MANUAL FOR
ADMINISTRATION OF THE PRETEST
AND POST TEST ACCOMPANYING THE
SECOND GRADE ETU IN MATHEMATICS

TESTER'S MANUAL

Experimental Teaching Unit

Mathematics - Grade 2

Materials needed to administer test:

Please be sure to have these.

Test booklet for every child
Centimetre ruler for every child
Plastic bag containing 10 squares, 1 long string, and 1 short string.
1 - ball of clay
1 - 8 oz. measuring cup filled with water
1 - 8 oz. flat empty container

General Information

At the beginning of the test session give the teacher a copy of the test. Say something like, "You might want to look through a copy of the test." Let the teacher keep the test during the test session, but be sure to get the test back at the end of the session. Do not let the teacher keep a copy of the test. Explain to the teacher that the Unit should cover these general areas of math rather than the specific items on the test. Point out that Activities and Worksheets in the Unit are very similar to the test items.

During the testing it will be necessary to read every problem to the students and to circulate around the room, making sure that students have understood the directions correctly. A student who is confused may raise his hand for help. If this happens, repeat the problem to the child. You may point out to him where he is supposed to read and mark. But do not help him answer the problem.

The teacher may want to help circulate and answer questions. This is permissable as long as the teacher understands that he/she may only repeat the problem and not help the student answer the question or try to explain the problem more clearly.

Some children may find the problems frustrating because they have never done these kind of problems before. Try to encourage such children to figure out what they can. Say something like:

> YOU ARE GOING TO BEGIN A UNIT ON MEASUREMENT. YOUR TEACHER NEEDS TO KNOW WHAT YOU ALREADY KNOW AND WHAT YOU NEED TO LEARN. SOME OF THE PROBLEMS IN THIS BOOKLET YOU MAY NOT KNOW HOW TO DO. BUT TRY TO DO THE BEST YOU CAN.

Grade 2

Before beginning testing, make sure that desks are clear, and that each child has a pencil. Try to seat children some distance apart or put dividers between them.

> GOOD MORNING, BOYS AND GIRLS. TODAY WE WOULD LIKE YOU TO DO SOME MATH WORKSHEETS. WE WANT TO FIND OUT WHAT YOU KNOW ALREADY AND WHAT YOU NEED TO LEARN. PLEASE DO YOUR VERY BEST WORK ON THESE MATH WORKSHEETS.
>
> NOW I WILL PASS OUT A SMALL BAG. IN IT YOU WILL FIND 10 SQUARES, 1 LONG PIECE OF STRING, AND 1 SHORT PIECE OF STRING. WHEN YOU GET YOUR BAG, OPEN IT AND CHECK TO SEE IF YOU HAVE ALL THESE MEASURING UNITS.

Put out the bags. Print teacher's and school's name on blackboard.

> NOW I WILL PASS OUT A CENTIMETRE RULER (hold up the ruler). AND THE WORK BOOKLETS.
> WHEN YOU GET YOUR BOOKLET, PUT YOUR FULL NAME, BOTH YOUR FIRST AND YOUR LAST NAME, ON THE LINE. UNDERNEATH YOUR NAME, PUT YOUR TEACHER'S NAME. ON THE BOTTOM LINE, PUT YOUR SCHOOL'S NAME. DO NOT OPEN THE BOOKLET.

Pass out the centimetre rulers, then the booklets. Let the teacher help with last name. Circulate around the room to see that children are following directions.

> WHEN YOU HAVE FINISHED, LOOK UP AT ME, SO I WILL KNOW YOU ARE READY TO BEGIN.

When all are ready, begin the test.

> OPEN THE BOOKLET TO THE FIRST PAGE, LABELED "GENERAL DIRECTIONS". I WILL READ THE DIRECTIONS TO YOU.

Show children the correct page. When all are ready, read the page.

IN THIS BOOKLET MOST OF THE TIME YOU WILL CIRCLE THE ANSWER YOU CHOOSE. THE WORK WILL BE READ TO YOU, ONE PROBLEM AT A TIME, SO THAT YOU CAN WORK THE PROBLEM AFTER IT IS READ.

HERE ARE SOME SAMPLE PROBLEMS FOR US TO WORK TOGETHER. PUT YOUR PENCIL ON 1A SO I CAN SEE EVERYONE IS IN THE CORRECT PLACE.

Circulate around the room and check to see children are on the correct problem.

Then read:

1A. CIRCLE "YES" IF THE SENTENCE IS CORRECT. CIRCLE "NO" IF THE SENTENCE IS WRONG.

ROD A AND ROD B ARE THE SAME LENGTH. LOOK AT ROD A AND B. ARE THEY THE SAME LENGTH? (Allow a child to answer...NO.) THAT'S CORRECT. SO IS THE SENTENCE CORRECT OR WRONG? (Allow a child to answer...WRONG.) WHICH SHOULD YOU CIRCLE YES OR NO? (Allow a child to answer...NO.) GOOD. EVERYONE CIRCLE THE WORD "NO" TO SHOW THE SENTENCE "ROD A AND ROD B ARE THE SAME LENGTH." IS WRONG.

Circulate around the room to see if all children follow directions. Then read:

LOOK AT 1B. IT SAYS: LINE A IS SHORTER THAN LINE B. WHICH WOULD YOU CIRCLE, YES OR NO? (Allow a child to answer...YES.) THAT'S CORRECT. EVERYONE CIRCLE THE CORRECT ANSWER.

Check to see that children are still following directions. Then read:

LOOK AT 1C. IT SAYS: THE AREA OF FIGURE A IS GREATER THAN, SMALLER THAN, THE SAME AS, THE AREA OF FIGURE B.

NOW LOOK AT FIGURE A AND FIGURE B. HOW ARE THEY RELATED TO EACH OTHER?

IS THE AREA OF FIGURE A GREATER THAN THE ARE OF FIGURE B?
(Allow a child to answer...NO.)

IS THE AREA OF FIGURE A SMALLER THAN THE AREA OF FIGURE B?
(Allow a child to answer...NO.)

IS THE AREA OF FIGURE A THE SAME AS THE AREA OF FIGURE B?
(Allow a child to answer...YES.)

WHICH ONE OF THE 3 SHORT LINES IN THE SENTENCE SHOULD YOU CIRCLE? (Allow a child to answer...THE SAME AS OR THE BOTTOM LINE, ETC.)

THAT'S CORRECT. EVERYONE CIRCLE THE CORRECT ANSWER.

Circulate around the room to make sure everyone has followed directions. Then ask:

ARE THERE ANY QUESTIONS ABOUT WHAT YOU ARE GOING TO DO?
(Wait for response.)

PLEASE TURN TO THE NEXT PAGE. THE PAGE MARKED NUMBER 1.

Read all problems slowly and deliberately, so most children have enough time to answer the problems. You may reread problem. However, problem should be read only twice.

Read:

CIRCLE THE ANSWER.

1. THE AREA OF FIGURE A IS GREATER THAN, SMALLER THAN, THE SAME AS, THE AREA OF FIGURE B.

2. THE BACK OF CHAIR A IS WIDER THAN, NARROWER THAN, THE SAME AS, THE BACK OF CHAIR B.

("Wider" may be defined as "bigger across.")
("Narrower" may be defined as "thinner across.")
("Back of chair" may be defined as "across the back of the chair.")

3. CIRCLE THE METRIC UNIT YOU WOULD USE TO MEASURE THE WEIGHT OF A CAN OF TUNA.

GRAM LITRE METRE

WHEN YOU ARE FINISHED WITH THIS PAGE, TURN TO THE NEXT PAGE, SO I'LL KNOW TO BEGIN READING AGAIN.

Read:

Page 2:

4. CIRCLE THE FIGURE THAT IS BOTH THE LONGEST AND THE THICKEST.

5. CIRCLE THE BOX THAT IS BOTH THE DEEPEST AND THE NARROWEST.

6. CIRCLE THE METRIC UNIT YOU WOULD USE TO MEASURE THE AMOUNT OF LIQUID IN A CARTON OF MILK.

   CENTIMETRE LITRE METRE

WHEN YOU ARE FINISHED WITH THIS PAGE TURN TO THE NEXT PAGE, SO I'LL KNOW TO CONTINUE READING.

Read:

Page 3:

7. CIRCLE "YES" IF THE SENTENCE IS CORRECT. CIRCLE "NO" IF THE SENTENCE IS WRONG.

   LINE A IS LONGER THAN LINE B.

8. NOW, LOOK AT ME. AFTER I DO SOMETHING WITH THIS CLAY, I'LL ASK YOU A QUESTION. YOU ANSWER BY CIRCLING THE "YES" OR "NO" IN YOUR BOOKLET.

(Take one large ball of clay. Break into 7 or 8 smaller pieces. Do not speak during this demonstration but make sure children can see what you are doing. When you are finished:)

   I HAVE MORE CLAY NOW THAN I HAD BEFORE.

   YES NO

9. CIRCLE THE SET THAT GOES FROM BIGGEST TO SMALLEST.

WHEN YOU HAVE FINISHED THIS PAGE, TURN TO THE NEXT PAGE, SO THAT I'LL KNOW TO CONTINUE READING.

Read:

Page 4:

10. CIRCLE THE SET THAT DOES NOT GO FROM SMALLEST TO LARGEST, OR LARGEST TO SMALLEST.

11. IF YOU TRIED TO FIND OUT HOW MUCH WATER IS IN A BUCKET, WHICH COULD YOU USE? CIRCLE THE ANSWERS. MORE THAN ONE ANSWER MAY BE CORRECT.

    A. A BOTTLE
    B. A WOODEN BLOCK
    C. A CUP
    D. A TABLE
    E. A CLOCK

12. CIRCLE THE ANSWER. ONLY ONE ANSWER IS CORRECT.

    CENTIMETRES ARE UNITS TO MEASURE:

    A. HOW MUCH A PACK OF GUM WOULD COST.
    B. HOW MUCH A BOOK WEIGHS.
    C. HOW LONG YOUR FOOT IS.
    D. HOW MUCH TIME YOU SPEND ON THE PLAYGROUND.
    E. NONE OF THESE

TURN TO PAGE 5, SO I'LL KNOW TO CONTINUE READING.

Read:

Page 5:

13. CIRCLE "YES" IF THE SENTENCE IS CORRECT. CIRCLE "NO" IF THE SENTENCE IS WRONG.

    IF YOU USED YOUR SQUARES TO COVER FIGURES A, B, AND C, FIGURE C WOULD BE COVERED WITH THE MOST SQUARES.

TURN TO PAGE 6 WHEN YOU HAVE FINISHED.

Read:

Page 6:

14. CIRCLE "YES" IF THE SENTENCE IS CORRECT. CIRCLE "NO" IF THE SENTENCE IS WRONG.

    IF YOU CUT OUT AROUND THE DOTTED LINES, YOU WILL HAVE MORE PAPER LEFT IN FIGURE A.

TURN TO PAGE 7 WHEN YOU HAVE FINISHED.

Read:

Page 7:

15. NOW, LOOK AT ME. AFTER I DO SOMETHING WITH THESE CONTAINERS, I'LL ASK YOU A QUESTION. YOU ANSWER BY CIRCLING "YES" OR "NO" IN YOUR BOOKLET.JK

(Take the 8 oz. cup. It should be filled with about 8 oz. of water. Hold cup up for class to see. Hold the flat, empty container up for the class to see. Pour water into empty container without saying anything. Be sure children see what you're doing. Then ask:)

BOTH OF THESE CONTAINERS HOLD THE SAME AMOUNT OF WATER.

YES NO

16. CIRCLE THE SETS OF STARS THAT GO FROM SMALLEST TO LARGEST.

WHEN YOU'RE FINISHED, TURN TO PAGE 8.

Circulate around the room to make sure children are following directions.

Read:

Page 8:

17. CIRCLE THE SHORTEST LINE.

18. PUT AN "X" ON THE LONGEST LINE.

19. IF YOU WERE TO PUT THE LINES ABOVE FROM LONGEST TO SHORTEST, HOW WOULD THEY GO?
WRITE THE LETTERS TO SHOW WHAT YOU WOULD DO.

(Put 1st line _____ (longest line) on the blackboard. Then say:)

WHICH LINE DID YOU THINK WAS THE LONGEST? YOU PUT AN "X" ON IT. PUT THE LETTER OF THAT LINE ON THE BLANK BESIDE "1ST LINE, LONGEST LINE.

(Show children on the blackboard, but don't use "X" or any-other letter.)

WHICH LINE IS NEXT TO THE LONGEST? PUT THE LETTER OF THAT LINE ON THE BLANK BESIDE "2ND LINE. (You may want to demonstrate again on the blackboard.)

WHICH IS THE MIDDLE LINE? PUT THE LETTER OF THAT LINE ON THE BLANK BESIDE "3RD LINE". (Use blackboard if necessary.)

WHICH LINE IS NEXT TO THE SHORTEST LINE? PUT THE LETTER OF THAT LINE ON THE BLANK BESIDE "4TH LINE.

WHICH LINE IS NEXT TO THE SHORTEST LINE? PUT THE LETTER OF THAT LINE ON THE LAST BLANK. THE ONE THAT SAYS 5TH LINE ____(SHORTEST LINE).

WHEN YOU"RE FINISHED TURN TO PAGE 9.

Read:

Page 9:

20. CIRCLE THE LINE THAT IS SHORTER.

21. HOW MUCH SHORTER? USE YOUR STRING TO FIND OUT. CIRCLE THE ANSWER.

1 STRING 2 STRINGS 3 STRINGS 4 STRINGS 5 STRINGS

ONE OF THE STRINGS WILL HELP YOU FIND THE ANSWER. BUT I CAN'T TELL YOU WHICH ONE. YOU MUST FIGURE THAT OUT YOURSELF.

22. HOW MANY LITTLE FISH IN A LINE ARE AS LONG AS THE BIG FISH?

CIRCLE THE ANSWER.

2 FISH 3 FISH 4 FISH 5 FISH 6 FISH

WHEN YOU ARE FINISHED TURN TO PAGE 10.

Read:

Page 10:

23. USE YOUR SQUARES TO FIND OUT:

HOW MANY MORE SQUARES ARE THERE IN FIGURE B THAN FIGURE A?

CIRCLE THE ANSWER.

1 SQUARE 2 SQUARES 3 SQUARES 4 SQUARES 5 SQUARES

24. USING YOUR SQUARES, MEASURE THE AREA OF FIGURE A TO THE NEAREST SQUARE.

CIRCLE THE ANSWER.

6 SQUARES 7 SQUARES 8 SQUARES 9 SQUARES 10 SQUARES

WHEN YOU ARE FINISHED, TURN TO PAGE 11.

Read:

Page 11:

25. CIRCLE THE ANSWER.

LITRES ARE USED TO MEASURE:

A. HOW TALL THE TEACHER IS.
B. HOW LONG YOUR ARM IS.
C. HOW HEAVY 5 PENNIES ARE.
D. HOW MUCH WATER IS IN A DISHPAN.
E. NONE OF THESE

26. IF THIS WERE A REAL BOX,
CIRCLE ALL THE THINGS YOU COULD MEASURE ON THE BOX.

A. WHAT THE BOX IS MADE OF.
IF YOU CAN MEASURE THAT, CIRCLE LETTER A.

B. HOW DEEP THE BOX IS.
IF YOU CAN MEASURE THAT, CIRCLE LETTER B.

C. WHAT COLOR THE BOX IS.
IF YOU CAN MEASURE THAT, CIRCLE LETTER C.

D. THE DISTANCE AROUND THE BOX.
IF YOU CAN MEASURE THAT, CIRCLE LETTER D.

WHEN YOU HAVE FINISHED, TURN TO PAGE 12.

Read:

Page 12:

27. HERE IS A PICTURE OF A KANGAROO.
CIRCLE ALL THE THINGS YOU COULD MEASURE ABOUT THIS KANGAROO.

A. HOW LONG THE KANGAROO IS.
IF YOU CAN MEASURE THAT, CIRCLE LETTER A.

B. WHAT COLOR HIS EYES ARE.
IF YOU CAN MEASURE THAT, CIRCLE LETTER B.

C. HOW MEAN THE KANGAROO IS.
IF YOU CAN MEASURE THAT, CIRCLE LETTER C.

D. HOW LONG HIS TAIL IS.
IF YOU CAN MEASURE THAT, CIRCLE LETTER D.

28. CIRCLE THE ANSWER.

GRAMS ARE USED TO MEASURE:

A. HOW LONG THE PLAYGROUND IS.
B. HOW MUCH 3 BEANS WEIGH.
C. HOW MANY BLOCKS FIT INTO A BOX.
D. HOW WIDE A BOOK IS.
E. NONE OF THESE

WHEN YOU ARE FINISHED, TURN TO PAGE 13.

Read:

Page 13:

29. USING YOUR CENTIMETRE RULER, MEASURE THE FOLLOWING LINE TO THE NEAREST CENTIMETRE.

CIRCLE THE ANSWER.

4 CENTIMETRES 5 CENTIMETRES 6 CENTIMETRES
7 CENTIMETRES 8 CENTIMETRES

30. USE THE SIDE OF YOUR SQUARES AND YOUR SHORT PIECE OF STRING TO MEASURE THIS LINE.

FIRST USE YOUR SQUARES. THEN USE THE STRING.

HOW LONG IS THIS LINE? CIRCLE THE ANSWER.

A. 6 SQUARES, OR 1 PIECE OF STRING

B. 5 SQUARES, or 2 PIECES OF STRING

C. 4 SQUARES, OR 3 PIECES OF STRING

31. CIRCLE THE METRIC UNIT YOU WOULD USE TO MEASURE THE WIDTH OF YOUR FINGERNAIL.

CENTIMETRE LITRE GRAM

WHEN YOU ARE FINISHED, TURN TO PAGE 14.

Read:

Page 14:

32. USE A CENTIMETRE RULER. MEASURE THIS LINE SEGMENT TO THE NEAREST CENTIMETRE.

CIRCLE THE ANSWER.

5 CENTIMETRES 6 CENTIMETRES 7 CENTIMETRES

* 8 CENTIMETRES 9 CENTIMETRES

33. HOW LONG IS THE CHAIN OF PAPER CLIPS TO THE NEAREST CENTIMETRE.

CIRCLE THE ANSWER.

7 CENTIMETRES 8 CENTIMETRES 9 CENTIMETRES

10 CENTIMETRES 11 CENTIMETRES

WHEN YOU ARE FINISHED, TURN TO PAGE 15.

Read:

Page 15:

34. LOOK AT THIS BALANCE SCALE.

HOW MANY GRAMS DOES THE CAN WEIGH? CIRCLE YOUR ANSWER.

2 GRAMS 3 GRAMS 4 GRAMS 5 GRAMS 6 GRAMS

WHEN YOU ARE FINISHED, TURN TO PAGE 16.

Read:

Page 16:

35. SUPPOSE YOU POUR ALL THE MILK FROM A CARTON INTO A LITRE MEASURE.

HOW MUCH MILK WAS IN THE MILK CARTON? CIRCLE THE ANSWER.

4 DECILITRES 5 DECILITRES 7 DECILITRES

8 DECILITRES 1 LITRE

WHEN YOU HAVE FINISHED, CLOSE YOUR BOOKLET. IF THERE WAS SOME PART YOU DIDN"T GET TO FINISH BEFORE, GO BACK AND FINISH IT NOW.

You may re-read any problem to any child. When all children have finished:

PUT ALL THE SQUARES AND THE 2 PIECES OF STRING BACK IN YOUR BAG.

Collect bags. Collect centimetre rulers and give those to teach. Make sure she knows children are to use these for the unit and the post test.

Collect the booklets. Make sure the child's full name is on the cover.

Changes for Posttest

Change the opening speech to:

> YOU HAVE DONE SOME WORK IN MEASUREMENT. NOW WE WANT TO FIND OUT HOW MUCH YOU HAVE LEARNED. IT IS IMPORTANT THAT YOU WORK CAREFULLY.

The test itself is given exactly the same way.

Make no secret of the fact that the booklet is the same. But encourage children to do their best work this second time. Ask them to do their best work, even though they've done it before.

APPENDIX F

THE SECOND GRADE
ETU IN MATHEMATICS

Experimental Teaching Unit

Second Grade

MATHEMATICS

Developed by

Teacher Education Division
Far West Laboratory for
Educational Research & Development
1855 Folsom Street
San Francisco, Ca 94103

Introduction to the Unit

This Experimental Teaching Unit is intended to give students some practice in important mathematics skills. There are five sections to the unit, each of which deals with slightly different skills.

For each section the following things are included in this packet:

1. a brief overview of the skill area
2. a list of performance objectives for the students
3. a set of sample instructional materials (you may use those included, select some from another source, or create your own)
4. some suggestions on ways to use the materials and/or other related materials.

Your students will be both pre- and posttested on many of the objectives listed in this unit. To keep the testing to a minimum not all of the objectives are tested directly. Individual scores on the pretest will be provided for you.

Please spend about 25 minutes each day on work related to these objectives. This means that a student working on unit activities should spend no more than about 25 minutes total during the day.

There are many different ways of organizing the materials and of relating one objective to another. Many exercises can be planned to cover more than one objective. If you wish, objectives from different areas can be included in the same lesson. We are interested in the variety of ways to teach these mathematics skills. You may teach as much of the unit to as many of your students as you wish, and in any manner you choose.

As much as possible, please keep track of what materials and activities you use to teach the unit. To help you do this, please follow these procedures:

1. Each of the five sections in the ETU is composed of a set of instructional objectives.
   (a) For each section, select the objectives you plan to use.
   (b) Arrange the objectives in the order in which you paln to use them and place the appropriate number in the space provided. (You will use this number to identify each objective on your teaching record, so do this before you begin the unit.
2. Use the Daily Teaching Record, to keep track of the instructional objectives and the materials or activities you focus on each day.

At the end of the unit we would like to get information from you on questions like:

1. What materials did you use (either from the packet or of your own devising)?
2. In what order were objectives and materials used?
3. Which materials/activities worked well and which less well?
4. What was the reaction of the children to the unit?
5. What procedures did you use for teaching different objectives?

We hope you, as teachers, will feel free to try out different approaches to teaching this unit.

Overview of the Unit

The purpose of this unit is to develop basic concepts of measurement. The child will have a variety of experiences which make measurement concepts meaningful to him. This unit will provide some review of counting skills and simple addition and subtraction skills. The primary focus, however, is to build concepts of measurement in length, weight or mass, volume or capacity, and area and extend them into a simple introduction to the metric system. Activities in each subtopic of this Experimental Teaching Unit suggest ways to accomplish that. The subtopics are: comparisons, ordering, conservation, arbitrary units of measuring, and standard units of measuring.

The introduction of the metric system can help develop a stronger feeling for measurement because of the way metrics tie directly into our decimal system of numeration. Pupils can be given extensive opportunities to use measurement tools and acquire skills useful in adult life. This unit should provide a firm foundation for introducing and building the concepts of measurement.

COMPARISONS

Measurement is the process of associating some physical attribute to objects being compared. A child must make many comparisons between objects, using an attribute that is common to all of them, so that measurement activities make sense to him.

Comparisons, in this unit, can be made directly, which means physically moving two or more objects together for comparison; and indirectly, which means using an instrument to compare two or more immovable objects. Comparisons can be made in such a way as to develop a sense of relationships and to develop a notion of length, area, weight or mass, and volume or capacity. Comparisons can also aid the child in becoming more aware of the physical properties of the objects and shapes he handles. "Big" and "small" become better defined and measurable in many ways. Some notions of the number of one attribute compared to the same attribute of another object can be developed. This involves repeated units or a set compared to an object.

OBJECTIVES

The child should be able to:

_____ Compare two or more objects either movable or immovable according to one property and describe them using one of the following terms:

bigger than - or taller, larger, heavier, wider, thicker, longer, etc.
smaller than - or shorter, lighter, narrower, thinner, etc.
the same as - or as tall as, as large as, as thin as, etc.

_____ Compare two or more objects either movable or immovable according to several properties and describe them using one of the following terms:

bigger than - or taller, larger, heavier, wider, thicker, longer, etc.
smaller than - or shorter, lighter, narrower, thinner, etc.
the same as - or as tall as, as large as, as thin as, etc.

CONSERVATION

Conservation refers to the fact that certain properties of objects do not change when you change the position or arrangement of the objects. A child who is able to recognize that a particular "measurement" of an object such as its length, weight (mass), area, or capacity (volume) remains unchanged inspite of any irrelevant transformation made to it, is said to have the ability to conserve the "measurement" involved. For example: if a clay ball is smashed into a pancake shape, the child would recognize that it still has the same weight or mass.

OBJECTIVES

The child should be able to:

____ Recognize that an object weighs the same despite any change in shape or position.

____ Recognize that an object is the same length despite any change in shape or position.

____ Recognize that an object contains the same amount despite any change in shape or position.

____ Recognize that an object has the same area despite any change in shape or position.

ORDERING

The process of comparing can be extended to include the same attribute of any other objects between the "biggest" (tallest, widest, heaviest, etc.) and the "smallest" (shortest, narrowest, lightest, etc.). Ordering can be made through simple comparisons in which the child makes a step arrangement using the method of finding which is next to the "biggest", etc. Or ordering arrangements can be made by using a third object, such as a cup, a metal washer, a strip of paper, and finding out how many cups, metal washers, or strips of paper equal each, and then ordering the objects according to how many was equal to each object.

OBJECTIVES

The child should be able to:

_____ Arrange several objects in order according to one property. (numbers involved)

_____ Arrange several objects in order according to any one property. (numbers not involved)

ARBITRARY UNITS OF MEASURE

Arbitrary units of measure are natural for children to use in their introductory work in measurement. The instruments can be larger (longer) than the object being measured or they can be smaller (shorter), requiring more than one of them to measure the object. Some decision has to be made as to which to use. At this stage there can be a need for counting and noticing that measurement should be as accurate as possible. An object can be measured with respect to more than one dimension.

OBJECTIVES

The child should be able to:

_____ Recognize the various measures of an object.

_____ Use arbitrary units to describe "how much more" (or how much less) one object is than another.

_____ Recognize a unit of measure is arbitrary by using more than one unit or measuring instrument to measure the given property of an object.

_____ Use an appropriate measuring instrument.*

_____ Estimate the measure of an object.*

_____ Measure an object with accuracy to the nearest arbitrary unit.

*These are important objectives but are not directly tested.

STANDARD UNITS OF MEASURE

The metric system is a more logical system than the English system and it is much easier to learn and use because it is a decimal system. Our money system (dollars and cents) is a decimal system. This means that the units of measure that it uses are based on powers of ten. For example, the metre, the basic unit of length is equal to 10 decimetres, or 100 centimetres.

The whole system is built up by multiplying or dividing by 10, 100, or 1000. Greek prefixes refer to the multiples and Lating to the sub-multiples.

Metric Prefixes	
milli	1/1000
centi	1/100
deci	1/10
deka	10
hecto	100
kilo	1000

There are only three (3) basic units of measure in the metric system to which these prefixes are applied:

Metre - to measure length

Litre - to measure volume or capacity

Gram - to measure weight or mass

OBJECTIVES

The child should be able to:

_____ Name the three basic metric units of measure for length, volume or capacity, and mass or weight.

_____ Choose the appropriate metric unit of measure for a stated common object.

_____ Measure a given length (less than 20 centimetres) to the nearest centimetre.

_____ Weigh a given object (less than 10 grams) to the nearest gram.

_____ Find the liquid measure (less than 2 litres) of a given container to the nearest decilitre.

Suggested Activities - CONSERVATION

CO1. Make two clay balls that have the same weight. Use a balance scale to make sure they are the same weight.

a) Take one clay ball and make it into a pancake. Will the pancake have the same weight as the ball?

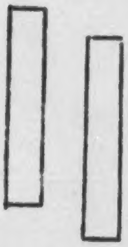
b) Take one clay ball and break it into pieces; make each piece into a small ball. Will the small balls have the same weight as the big ball?

CO2. Provide a number of boxes of different shapes, but which all hold the same amount (cubes or scoopfuls). These boxes may have to be made, or cut from other boxes. Allow children to discover they all hold the same amount, regardless of looks. If they all hold the same amount, is the amount of space inside them about the same?

CO3. Use two sticks of the same length. Do simple exercises such as these:

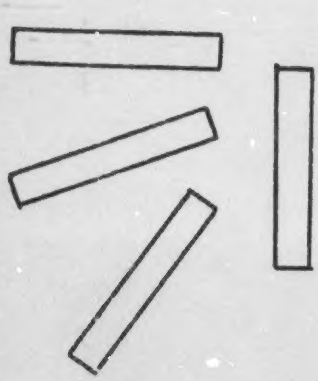
A.

Children should agree two sticks held like this are the same length.



Move one upwards. Children should still see they are both the same length.

B.

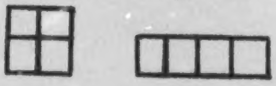


Start again with two sticks.

This time separate them in different directions, each time asking children if they are the same length.

C04. Activity C03 can be used to work with the conservation of area. Take an 8cm square and divide it into 4 equal smaller squares (2cm squares).

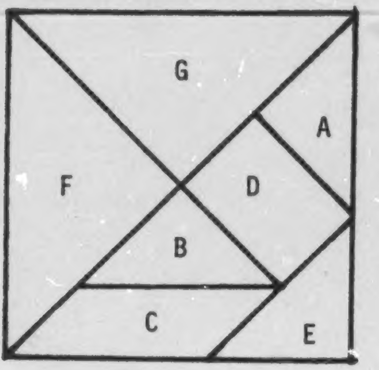
Put the four 2cm square units in a line.



Ask children for opinions as to the amount of area covered.

C05. Use a see-saw, try to find two children in the class that are the same weight, regardless of apparent physical differences. (A tall thin child may be as heavy as a short "chubby" child.) If no see-saw is available, use a plank and a brick to make a see-saw.

C06. Tangram pieces can be used. If none are available, you can make them using stiff paper 8" x 8". Use worksheet 110.



Many areas are equivalent. Children can cover various areas to find these relationships. Some are listed below but they are not sequential.

1. F = G
2. A+B = E
3. A+B = D
4. A+B = C
5. E = C = D
6. A+B+C+D+E = F+G

C07. Use a stick or a strip of paper and a string all the same length. "Measure" equal lengths and have children find them all to be the same.

Example:

piece of paper = 10cm

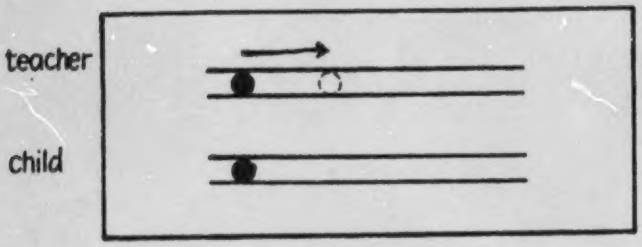
(but not marked)

coiled string
equals 10cm
(but not marked)

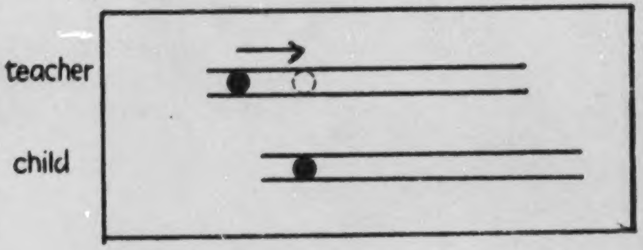
C08. Use worksheet 109 as group activity with sticks or strips of paper about 5cm long.

C09. The teacher should have five sheets of cardboard with parts drawn as illustrated in the diagrams below, and two small counters, which move along them, a green one for the top track and a red one for the lower track.

1


teacher
child

2


teacher
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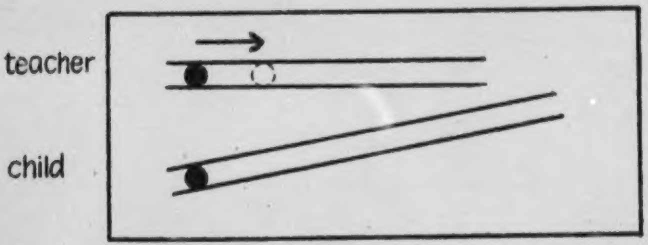
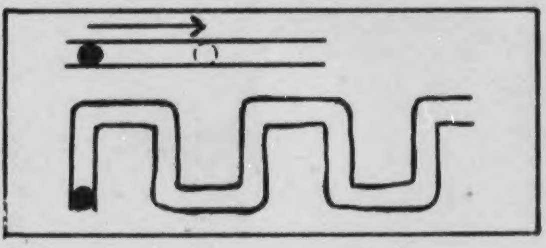
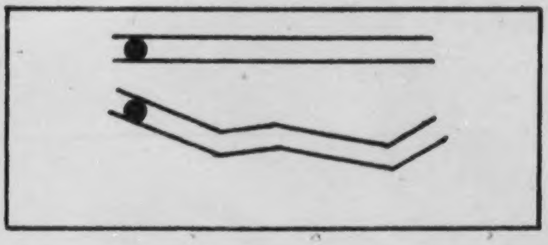
3


teacher
child

4



5



C09. (continued)

There should be on the table a number of measuring instruments, e.g. string, thread, pieces of paper, wooden sticks. There should also be some pieces of paper or sticks that are half the size of one of the segments of the bottom track in situation 4 and some that are the same lengths as the segments of the bottom track in situation 5.

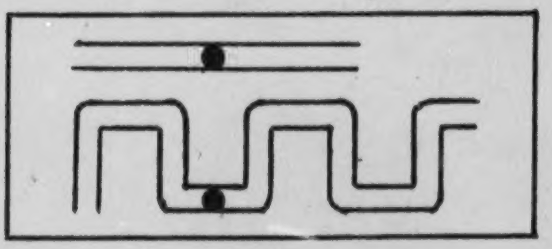
In the first three situations the procedure is identical. The teacher can explain to the child that the counters represent trains travelling along their tracks. "Each time my train is going to travel a certain journey" (the teacher's is always the one on the straight line) "and I'd like you to move yours so that it travels in the same distance as mine"; or, "I'd like your train to travel a journey as long as mine."

At the beginning of the check-up, before anything is explained to the child, the teacher can point to the various pieces of string and paper, sticks, etc., and tell the child that he can use these or anything else on the table to help him. These instructions are not repeated during the activity unless so indicated.

When the child has moved his train the teacher should ask him if there is any way he can be sure that it has travelled the same distance as the green one.

Should the teacher only be using the first three situations, and if the child has not made an attempt to measure, the teacher can then refer to the various pieces of string, sticks, etc. on the table and ask if these might be of help.

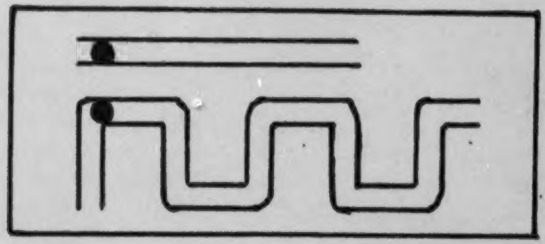
In the fourth situation, should the child place his train opposite the teacher's e.g.,



the teacher and the child should swap trains and return them both to their starting points. This time the teacher moves the red train to about the middle of the fourth segment and asks the child to move his train so that it travels the same distance. If the child still places his train opposite, both trains can be taken back to the shed. The teacher can then move the red one to the end of the first segment, and although it will have travelled a certain distance

C09. (continued)

it will still be opposite the green train, as this segment runs at right angles to the top track.



The child is then asked to move his train the same distance.

Another way of proceeding that may help the child is to suggest (when the teacher's train is at about the middle of the fourth segment) that the trains are going back to the shed. However, the teacher moves her train only one segment at a time and asks the child at each pause to move his train back an equal amount.

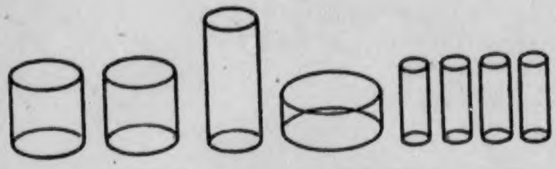
For the children who have been only visually estimating the distance moved by the two trains, the teacher can suggest that perhaps the string, thread or sticks might be of use.

C010. Use a jug of colored liquid, two glass beakers the same size and shape, one jar taller and narrower than the beakers and another shorter and wider, and a set of four glasses as nearly identical as possible, and much narrower than the beakers.

Pour some colored liquid into one of the glass beakers until it is about half full and ask the child to pour about the same amount into the other beaker. The child must agree that there is the same amount to drink in both glasses, before continuing.

There are three parts to this activity and the questions are the same in each. The water is poured from one of the beakers into the tall, thin jar and the child is asked: "Is there the same amount to drink in this glass as there is in the other beaker, or is there more in one?" He is also asked to explain his reply. Before pouring the water from the tall, thin jar back into the beaker the teacher asks the child to anticipate whether or not the two beakers will then have the same amount of water in them.

This procedure is repeated for the shorter but wider jar, and then by distributing the water between the set of four glasses, and each time the teacher should ask the same questions.



C011. The teacher should have two identical green sheets of paper or, preferably, cardboard and a number of cubes of sizes about 2.5cm. It should be explained to the child that the sheets of cardboard represent two fields belonging to two different farmers and that the cubes are supposed to be houses. The child should be asked to compare the two sheets of cardboard at the beginning to establish that they both cover the same amount of space. The farmers are now going to build houses, each on his own field: every time the first farmer builds one, the second farmer will do the same - one farmer will never build a house without the other building one as well. The teacher should make this very clear in her instructions by saying: "Each time one house is built here" (placing house on field) "another house will be built here" (placing a second house on the other field). In this way the child is able to establish the one-to-one correspondence between the two series. The houses are built close together on one sheet and scattered about on the other. After three houses have been built on each field the child is asked if there is still the same amount of space left in both fields.

C012. The teacher can have two identical sheets of paper, again representing two fields but not necessarily regular in shape. The child is asked to superpose one of the other so as to be certain that each contains about the same amount of space. There are two small brown squares, both about the same size, which represent ploughed patches or potato plots. The child can be asked to verify that the two potato plots are the same size, and then one is placed on each field. Once this has been done he can be asked two questions: firstly, "Do both the potato plots cover about the same amount of space on each field?" and secondly, "Is there still the same amount of grass left in both fields?"

One of the brown squares can then be cut into two rectangles which are placed end-to-end, and the child asked: "Is there still about the same amount of space for potatoes here" (in the first field) "as there is in this field?" (second field). Once the child has given his reply the teacher can make the rectangles into a square again and repeat the question, and then make them into a much more irregular shape and repeat it again.

Each time the teacher asks the question about the space available for the potatoes, she should also ask the question about the amount of grass left in the two fields.

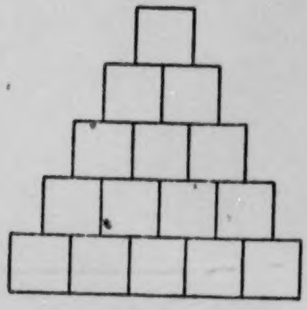
C013. Have several sheets of different colored thick paper and a pair of scissors. The child is asked to cut out two different colored gardens, or fields, in such a way that each garden will cover about the same amount of space as the other. The initial instructions are flexible so as to allow the teacher to see how the child understands the idea of "about the same amount of space." Should the child have difficulty, however, the following hint could be given: "In each garden or field we should be able to plant as many flowers or potatoes as in the other."

C013. (continued)

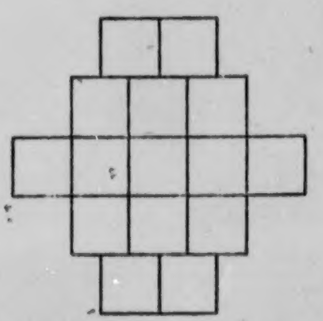
Once children have cut out two gardens that each have about the same amount of space, the teacher can ask them to cut out, from a different colored piece of paper, a third garden that has about the same amount of space as the others but a different shape.

C014. Have two rolls of paper, one about twice the width of the other. A length of paper sufficient to cover the surface of a table could be cut from one roll and the child asked to cut off about enough from the other roll to cover the same area.

C015. Have thirty squares, all the same size, divided into two sets of fifteen. Both sets are arranged in the same way: five squares wide and three squares high, and the child is asked to compare the two configurations. Once he has agreed that they both cover about the same amount of space, one of the sets can be rearranged into a pyramid, e.g.,



or a more symmetrical shape, e.g.,

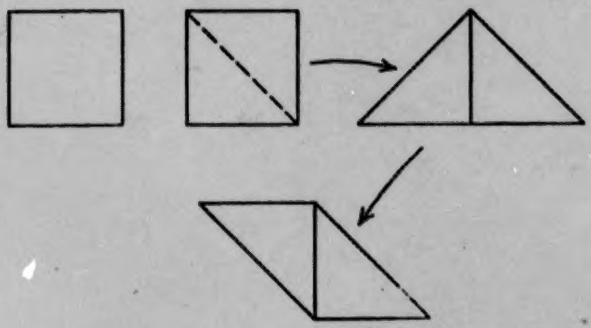


C015. (continued)

The child is then asked if the squares in one set still cover about the same amount of space as those in the other set. If the child has no difficulty with this situation, the squares can be put back into the original rectangle and then spread out into a straight line.

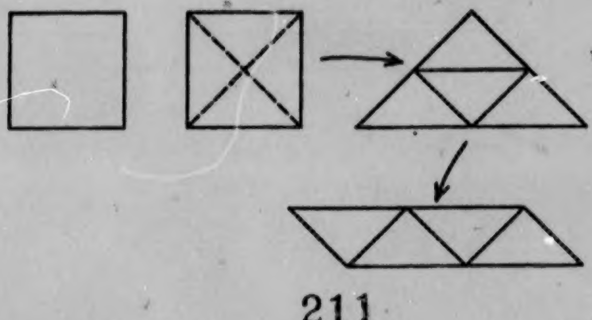
C016. Have three 10cm squares. The child is asked to compare all three squares and once he has established that they each cover about the same amount of space on the desk, one of the squares is cut in half along its diagonal and rearranged to form a triangle (see diagram below). The child can then be asked if the triangle covers as much space as one of the remaining sqaures. Next, the parts can be arranged to form a parallelogram and the same question asked.

Step 1: Diagram



In a second step, the child is asked to look at the two uncut squares and say whether he is sure they both cover the same amount of space. Once he has confirmed this, the two triangles are superposed on one of the squares to form a square again. The child is then asked if the two parts cover about as much space as the remaining square. When he agrees, the two triangles are cut in half along the second diagonal of the original square, after which the parts are rearranged in the following manners and the same questions asked as in Step 1.

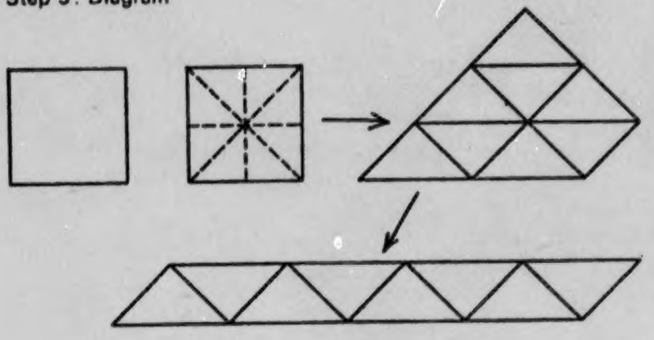
Step 2: Diagram



C016. (continued)

In the last step the procedure is the same as for Step 2, but this time the four right-angled triangles become eight by cutting along the axes of what was the original square. The parts are rearranged as shown below and the same questions asked:

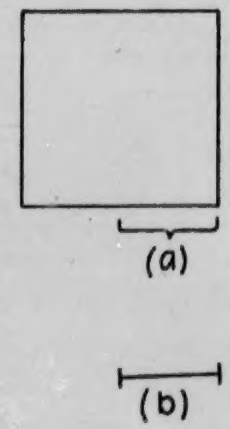
Step 3: Diagram



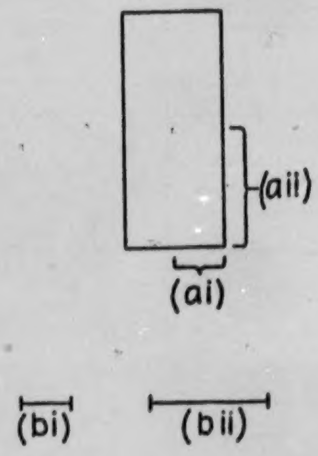
The teacher can use all three of the above-described steps or, according to need, only one or two of them, for example, jumping from 1 to 3 or only doing 1 and 2. In all the steps, the parts of the cut square go from a first new arrangement to a second different arrangement without returning to their original configuration in between.

C017. The child can be given a square or a rectangle and a piece of paper on which the teacher has drawn a line, say, half the length of one of the sides of the shape concerned. The child is asked to reproduce from this base another shape that will cover the same amount of space as the first one.

Situation 1:



Situation 2:



Suggested Activities - COMPARISONS

C1. Provide lots of opportunities for bringing two things together.

  a. Pouring or filling one container to another to see which holds more, or less.

  b. Cutting up a shape to see if it covers another or if it is larger or smaller.

  c. Sorting pairs of anything (shoes, children, toy cars, dolls, etc.) into longer and shorter.

  d. Holding two objects to see which is heavier, or which is lighter.

C2. Have child put his name on five tags. Then have him put tags on five things that are taller, wider, older, smaller, or heavier, etc., than he is.

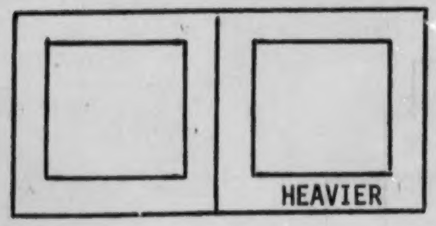
C3. Cut some ribbon (rope, yarn) into different size pieces. Select a piece to do the following activities:

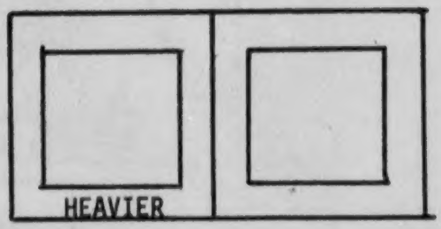
  a. Write the name of five things in the classroom longer than your rope.

  b. Write the names of five things in the classroom shorter than your rope.

  c. Write the names of three things in the classroom you found that were the same length as your rope.

C4. Find containers that are the same size (milk cartons with tops cut off). Set up in a work area pans or dish tubs filled with sand, marbles, cornmeal, beans, tea, nails, etc. Give the children scoops to fill each container with only one of the materials. Then have the children put the containers on cards according to comparison of weight.





C5. Collect a boxful of objects. Place two objects on each of four sheets of colored paper. Ask the child to place arrow cards between the pairs of objects to show how they are related.

IS TALLER →

HOLDS MORE →

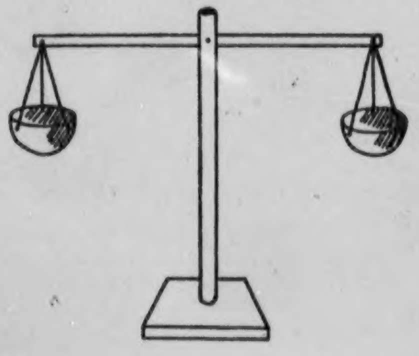
↔ IS THE SAME ↔

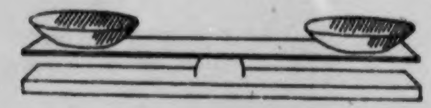
C6. Find pictures in magazine of objects, animals, etc. Cut out the pictures. Group the pictures in pairs on a piece of paper that has been folded into fractional parts. Make labels such as wider, taller, thinner, shorter, etc. Put an appropriate label on one of the objects in each pair.

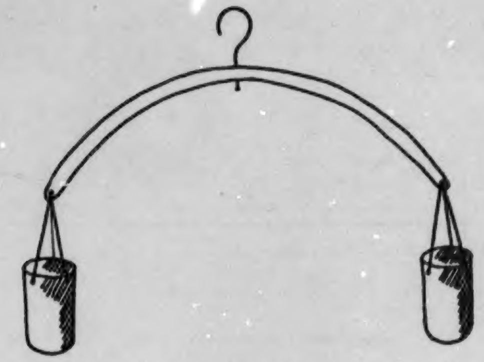
C7. Fill containers of not obviously different sizes with anything: marbles, sand, macaroni, etc. to compare which holds more (is larger). Some exercises could involve the same amount.

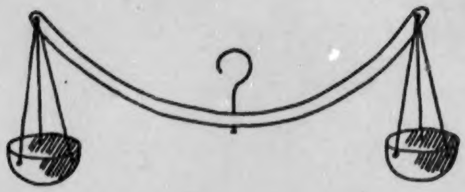
C8. Give the child two objects of different weights to hold in each hand. Have him decide which one is heavier or lighter, or whether the one is the same as the other.

C9. Use a simple balance with its pans to hold the two objects being compared. It is wise to begin by comparing objects of equal weight to show that the beam will remain level. Child can be lead through activities so that he understands how to use scale. Then provide opportunities to compare objects of varying weights. If no balance scale is available, you can make one, using a board and a brick, or a coat hanger and tin cans. Examples are shown below and on the next page.









C10. With a see-saw find out how two children compare to each other in weight.

C11. Using a balance scale have child find objects that will balance with one object (one cotton reel, one washer, etc.,). Questions like this can be asked: "How many nails will balance (weigh the same as) one cotton reel?"

C12. Provide a selected set of containers. They may be chosen for these reasons:

___ they provide a wide range of shapes (rectangular, conical, cylindrical, etc.)

___ they fit well inside each other

___ they show some ordering relationship (short-tall, one holds twice as much as the other)

___ they hold the same amount regardless of apparent looks.

Have child fill these to find relationships in set of containers. Filling materials could be: macaroni, rice, small stones, blocks or beads, metal bottle tops, corks, larger cereals, dried beans, etc.

C13. Give children a box of brightly colored ribbons and strings that vary in length and thickness and have them experiment with them to answer questions such as:

___ What things are as long as your ribbon?

___ Around what things does your ribbon (yarn) go?

___ Does your ribbon (yarn) go across the back of your chair?

___ Does your ribbon (yarn) go around your head?

___ What things are shorter or longer than your ribbon (yarn)?

C14. Use worksheets 101 and 102. Children can find the largest, the smallest and the shapes that are the same.

C15. Use activities C1, C3, C6, and C8. Instead of selecting pairs of things to compare, provide three or more things to compare, and find the "biggest," "smallest," or the ones that are equal.

C16. Have children decide which of two bookcase, desks, seats or chairs, etc. is larger (taller, longer, wider). These should not be noticably different. Choose things in the classroom which can not be moved to make comparisons. Have children devise ways of measuring these things such as a string, or a stick, and then compare the two.

C17. Give children a piece of yarn to measure parts of their bodies (head, foot, waist). Compare these. Find the "smallest," "largest" and the ones that are the same.

C18. Use body measurement (Activity C17) to find out how many head lengths equal a waist length, how many foot lengths equal the height of a body, etc.

C19. Select two or more children from class who appear to be the same height. Have children "measure" to find out which one is taller (tallest) or shorter (shortest). You may want to find out if they are the same weight.

C20. Cover the tops of two rectangular tables to find out which is larger or to find out if they are the same size in area. Strips of paper, squares, etc. can be used.

C21. Do activities like worksheet 104. Then find out which is shortest, which are the same.

C22. Have child put his name on five tags. Then have him put tags on five things taller and wider, older and smaller, etc., than he is.

C23. Collect a boxful of objects. Place two objects on each of four sheets of paper. Ask the child to place arrow cards between the pairs of objects to show how they are related.

IS TALLER AND HOLDS MORE →

C24. Use box of ribbons and strings (see C13). Have children find lengths that are the same color and thickness, short and wide, etc.

C25. Use any of the activities listed in this section, but provide children with opportunities to compare objects on the basis of 2 properties.

Suggested Activities - ORDERING

01. Collect at least five objects and arrange them in order from large to small. After the teacher checks your work, mix up the arrangement and see if a friend can put the objects in the same order.

02. Have a child fill some bowls, cups, bottles, etc., with any material. Then have him/her place the containers in order starting with the one that holds the largest amount of sand.

03. Select 3 to 5 children. Line them up according to some selected attribute. (hair length, etc.). Have children give the trait (attribute) that was used.

04. Mystery Packages Put different amounts of material in at least five boxes. Wrap each box with different type paper. Order each box according to size (volume). Then order the boxes according to their heaviness.

05. Give a child (or children) some assorted boxes, differing in size, weight, and shape, (there should be no obvious relationship between size and weight) and have them order the boxes by weight or volume (capacity).

06. Give a child (or children) identical containers, but each of a different weight, and have them order the containers.

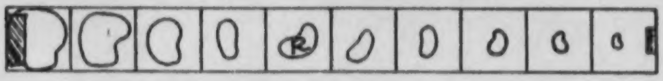
07. Collect leaves and arrange them in order according to area of each. Area could be determined by number of squares that will fit on each or comparison of shapes in which one overlaps the other and is therefore "bigger."

08. Have a box of ribbons and yarns that vary in length and thickness. Order accordingly.

09. Use geoboards if available, if not use page with dots arranged as on worksheets 106 and 107. Have children order rectangles or lines according to number of squares or dots included.

010. Divide class into groups. Have each group secretly decide a human attribute and what it means to have more less of it. The the group can decide who has most of it, who has the next most, and so on. When all groups are ready, each group can present its ordering to the rest of the class so that they can try to guess what attribute was used.

011. Use worksheet 108 with this game. The first child draws a reference card, places it in some middle space and puts a token marked "R" on it to show it is the reference. Successive players draw cards and place them on the proper side of the reference, this time establishing an order in each direction -- from the least area. Shapes already played will probably have to be moved from one space to another in order to place succeeding shapes correctly. When play is finished the board might look like this:



Suggested Activities - ARBITRARY UNITS OF MEASURE

A1. Present situation such as:

> "I'm thinking of moving this bookcase to the rear of the room to fit between the door and the blackboard. Another teacher told me that she didn't think there would be enough room for the bookcase there. How can I find out?"

Hopefully the children will suggest making a "ruler" to measure the length of the bookcase and of the space. They could also suggest a piece of paper or string to measure each length and make a decision. Emphasis is on non-standard units of measure.

A2. Give children these directions:

Take a piece of rope or yarn. Cut a piece that is longer than your height.

a) Measure around your wrist, tie a knot.
b) Measure from the same end of the string your foot, toe to heel, and tie a knot.
c) Measure around your head, tie a knot.
d) Measure around your waist, tie a knot.
e) Measure your height (a friend must help), tie a knot.

Now find how many of one unit equals another measurement on your body.

A3. Use "measurement units" from Suggested Activity A2, to compare two or more things in the classroom. Find out how many more units is one thing from another.

A4. Use a balance scale and provide materials to be weighed. (Materials can include: wooden blocks, marbles, nuts and bolts, large washers, etc.). Have children answer questions like these:

A. How many nails weigh about the same as 10 marbles?
B. How many metal washers weigh about the same as 10 wooden blocks?
C. How many nails weigh about the same as 10 wooden blocks?

A5. Use some fruit (or vegetables) and a balance scale to measure the weight of the fruit. The same materials in Suggested Activity A4 can be used again. Find out how many wooden blocks, marbles, etc. weigh about the same as the fruit.

Worksheet 111 can also be used.

A6. Find out how much bigger one desk top is from another by covering both with the same books, square pieces of paper, strips of paper, match boxes, etc. Have the children compare smaller surfaces. Would they use the book to do the measuring?

A7. Give children a variety of units to find out how much space is on top of their desk. Desk should be rectangular. Materials should include circles, triangles, squares, and irregular shapes. Children will discover why some can be used to measure the entire desk top and why others can not.

A8. Have children measure as many different dimensions on a box as is possible.

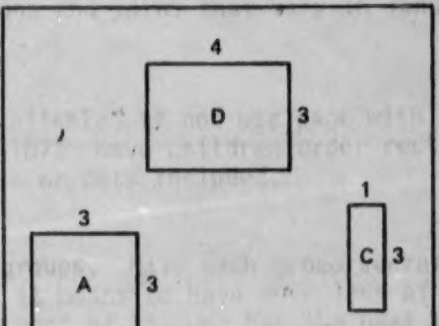
A9. Give children two containers, one slightly larger than the other. Have them find out how much bigger one of them is.

A10. Have children measure as many different things as they can about an adult. Let them use these attributes to describe the adult to some classmates, who try to draw this person. How are these drawings different from regular pictures?

A11. Ask children to select 5 "things" in the classroom; to identify or draw a picture of two attributes they could measure for each thing; and to tell or draw the measuring tool they would use for each measurement.

A12. If there are plants in the room, children can measure them to find out how much they have grown.

A13. Place a board in front of the child with A on the left as in the diagram. Put 36 inch cubes as a "block" on position A. Say "Here is a house on this island. It is built right up to the edge of the water, but it is not in the water.



A13. (continued)

"Using the other cubes, can you make a house on this island (point to B) so that it takes up the same space as the first (on A)? It must fill all the island." If necessary put the instructions as a story. "The people who live here (point to A) move and go to live here (point to B). They must have just the same amount of space in which to live, no more or no less." When the child has finished, do not ask him to explain what he has done, but go on to what follows keeping the building intact on B.

Leave the building on B and use more cubes. Repeat the procedure, this time for building on C a "house" with the same space as that on A. Tell the child to use more cubes and repeat for building on D as on A. As previously the building must fill all the surface of the island.

When the three buildings B, C, D are finished say "Explain (or tell me) what you have done. Are you sure that this house (point to B) contains the same amount of space as that (point to A)? Why?" Ask the same for C and D.

Finally, "How do you know that you are right?" Allow the child to make any alterations or movements that he wishes. Ask him for his reasons for these. Ask all the questions necessary to find out the procedures used by the child.

If the three buildings are equal in volume to A, stop the activity. If not go on to the following; ask each of these questions:

"This house (B) - does it occupy (have) the same amount of space or volume as that (C)?" Repeat for B and D. In the same way compare C and B, C and D and finally D and B, D and C.

A14. Have children use sheets of newspaper to measure the area of various floor and wall spaces around school or home.

A15. With each activity in this section have children estimate what their answer will be before actually measuring.

A16. With each activity in this section have different children check measurement for accuracy. Did both get the same measurement? If not, why?

A17. Use various units of measure to measure the same object. Example:

books and squares (10 sq. cm) to measure the teacher's desk; marbles or metal washers to weight the same as a pencil.

Is there any relationship between the size of the unit or measure and the amount you would have to use to measure? Which unit would be more accurate? The larger unit or the smaller unit? Develop various questions as children are exploring the use of several different units to measure the same thing.

A18. From activities on worksheets 124 and 125, discuss the various things used, e.g. marbles, sand, cubes for filling boxes and other containers; cups or match-boxes to measure the same needed to fill a container. Comparisons can be made - for some 3D shapes, e.g. some of the boxes.

Cubes provide an easy way of measuring the amount of space; for others, it is easier to use a small box to measure sand to fill the container. Further disucssion can bring out the difficulty of comparing the volume (capacity) of containers using these small boxes, etc., as match-boxes, cups, will vary.

SUGGESTED ACTIVITIES - STANDARD UNITS OF MEASURE

S1. Provide children with a metre. Have them measure both inside and on the playground. Record the findings and then have another group check for accuracy of measurement.

S2. Find the distance (length) between two unconnected objects. The need for a straight line will occur. Stretch a rope and measure along rope.

S3. Make a list of all the things that you think are about one (1) decimetre in length. Keep a record.

Objects estimated One decimetre	Measured length to the nearest cm.
Chalk	8 cm.

S4. Have two groups compare their results after measuring something with a unit of their choice. For such activities the teacher can introduce ideas about centimetres and metres.

S5. Have children find out how many grams are equal to whatever arbitrary unit they used to weigh things.

S6. Cut a piece of straw just this length: ———
Find some things in the room that are about that length. List them.

S7. Cut a piece of straw that is this length:

————————————————————

Find some things that are of that length. List them.

The length of this straw is called a decimetre. It is the same length as 10 centimetres.

S8. Measure various objects in the room. Find their measurements to the nearest centimetre or decimetre. Record the measurements and have another student check them.

S9. Use any of the activities listed in the Arbitrary Units section, using a metric measure instead of an arbitrary unit.

S10. Find 3 containers of different sizes and a litre measure. Fill the containers with water and then pour the water into the litre measure. Record the amount for each container to the nearest decilitre.

S11. Use a scale and metric weights. Weigh various small objects to the nearest gram.

OBJECT	WEIGHT (Gram)
paper clip	
penny	

S12. Provide situations in which children must choose the appropriate metric unit with which to measure an object.

Example: What would you use to measure the length of a candle?

S13. Make a collection of cans, bottles, and boxes. Find a way to measure around each container. Estimate the number of centimetres around each container.

OBJECT	ESTIMATED MEASURE (cm)	ACTUAL MEASURE (cm)

S14. Fill a plastic freezer bag with 10 grams (decigram) of sand. Make some estimates of those things which will have a mass or weight of nearly 10 grams (any weight can be substituted). Check your estimate.

OBJECT (estimated 10g)	LESS THAN 10g	ABOUT 10g	MORE THAN 10g

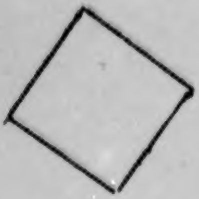
S15. Find containers in the supermarket that have their weight stated in metric measure. Make a list of these and how many grams each is.

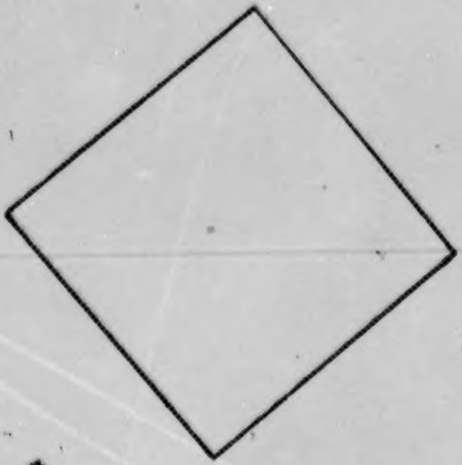
S16. Have students lay out 10 "decimetre straws." Mark the length on another piece of manila paper (or tag board). Cut out this new strip. Allow students to use it to measure themselves and things in the environment. Later on, introduce the name metre (10 decimetres) for this new unit.

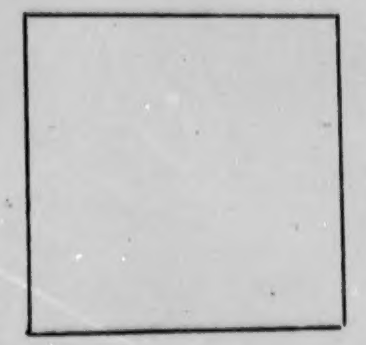
F-33

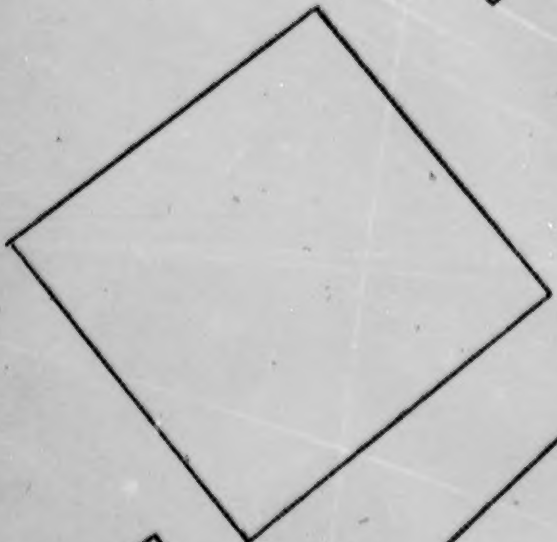
Name ____________________

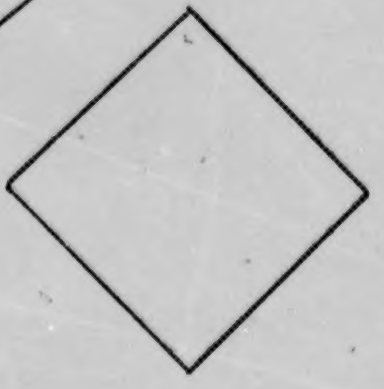
Cut out the shapes. Put them on top of each other. Which is the largest? Which is the smallest?

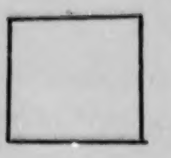


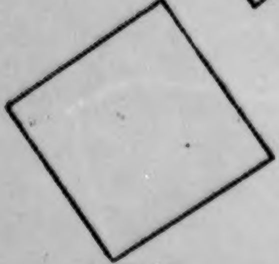








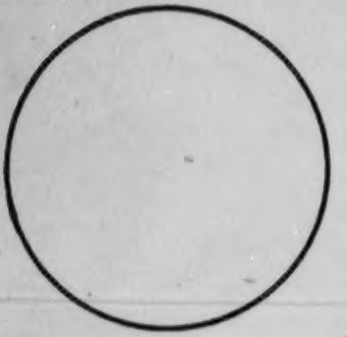


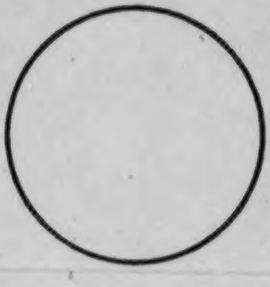


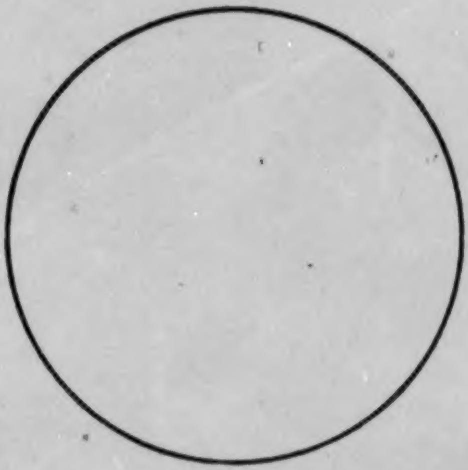
F-34

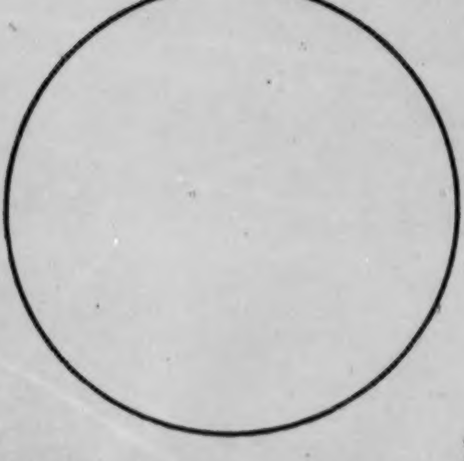
Name ______________________________

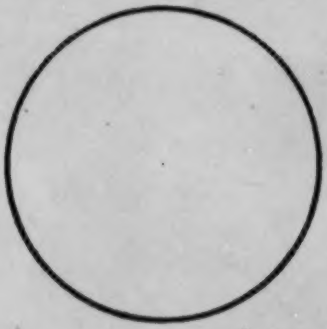
Cut out the shapes. Put them on top of each other. Which is largest? Which is smallest? Are there any that are the same?











Name ____________________

Cut out pictures from a magazine. Paste them on both sides of the arrow to show that the object in the picture is heavier.

IS HEAVIER →

IS HEAVIER →

IS HEAVIER →

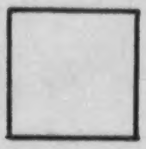
Name ____________________

Trace around your foot. Cut it out. Find out how many of your feet each of the things below is.

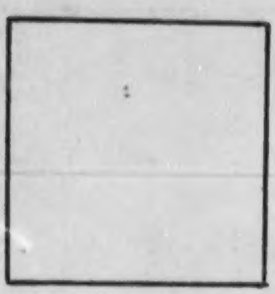
1. Your desk ____________________
2. The window ____________________
3. A sink ____________________
4. The shelves ____________________
5. Your chair ____________________
6. A door ____________________

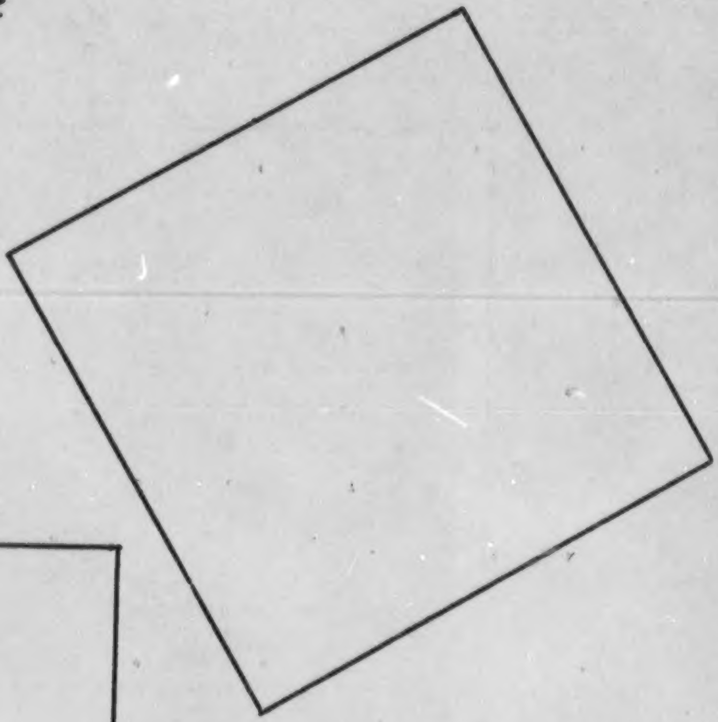
Name ______________________________

Cut out the square: →



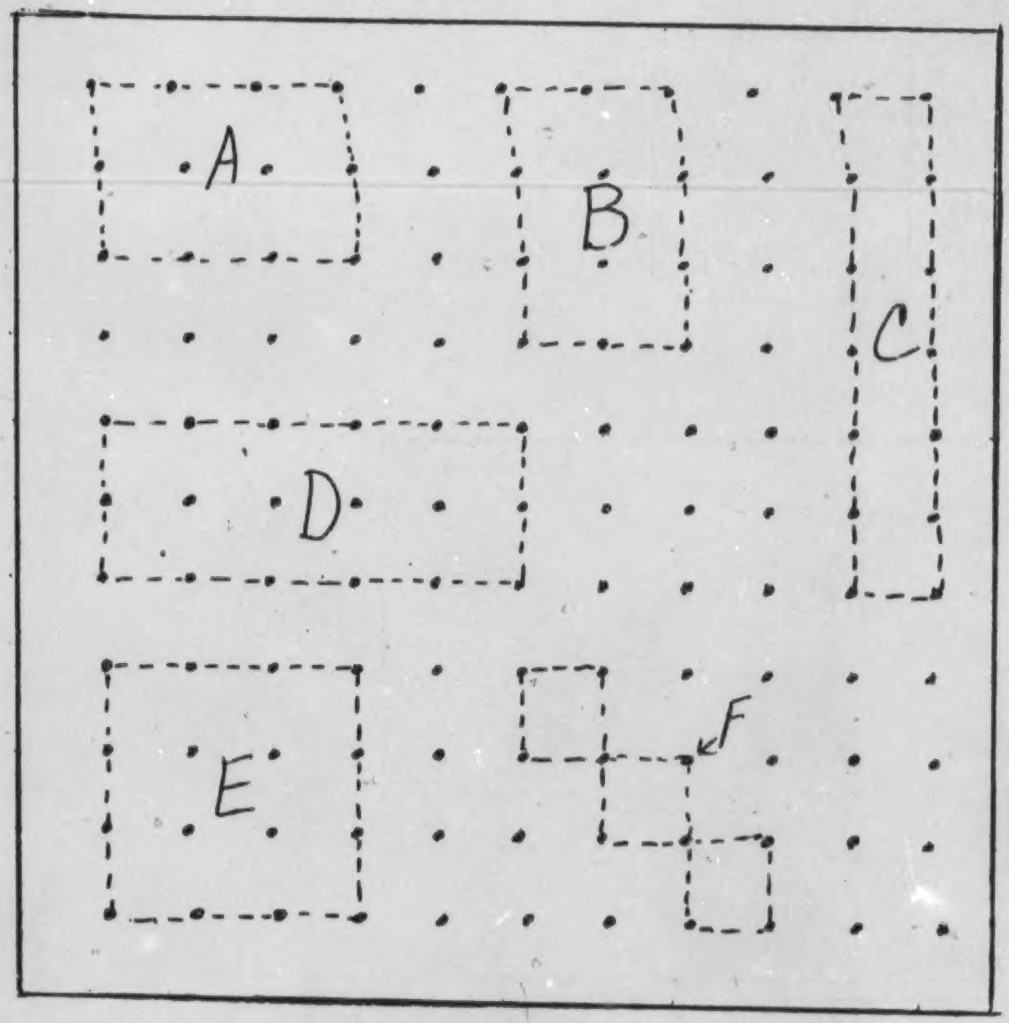
Find out how many squares fit in the boxes below.





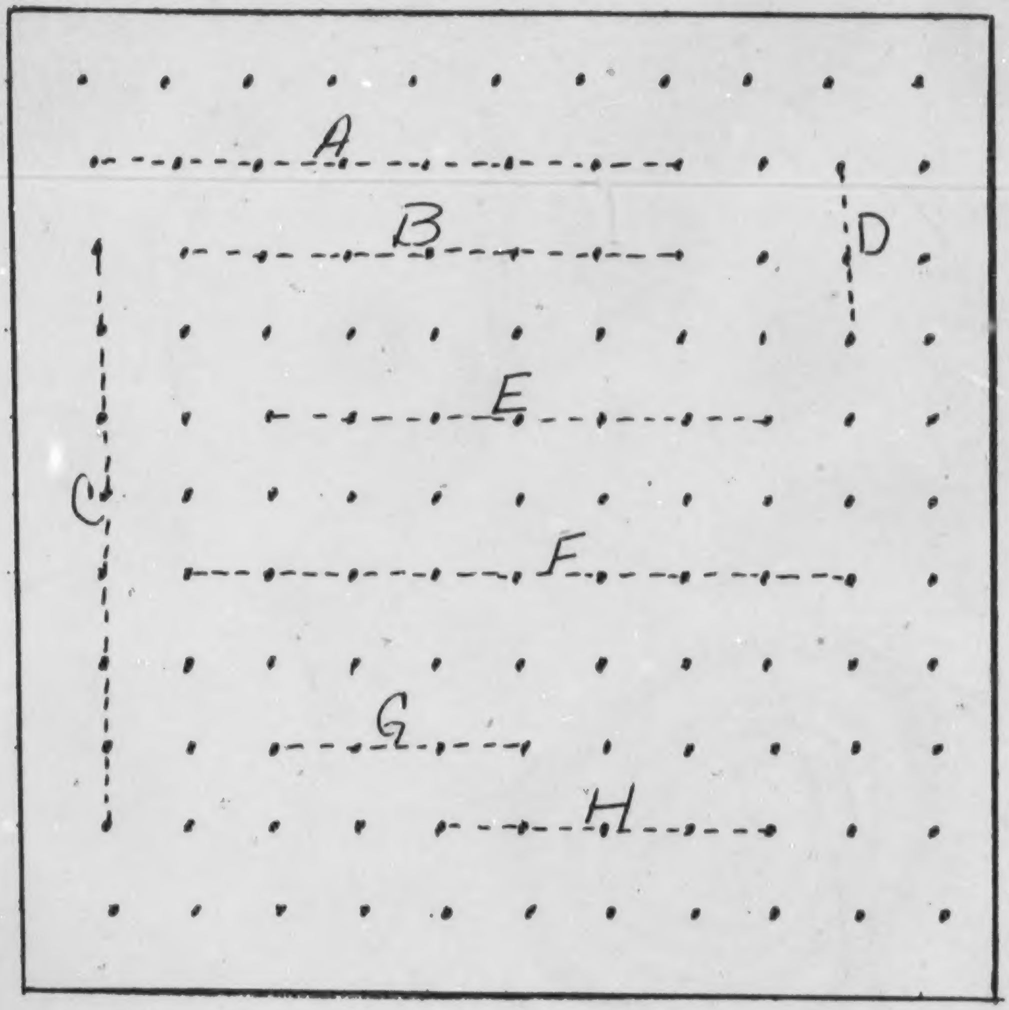
Name ________________

Find the largest shape
Find the smallest shape.
Find the ones that are the same.



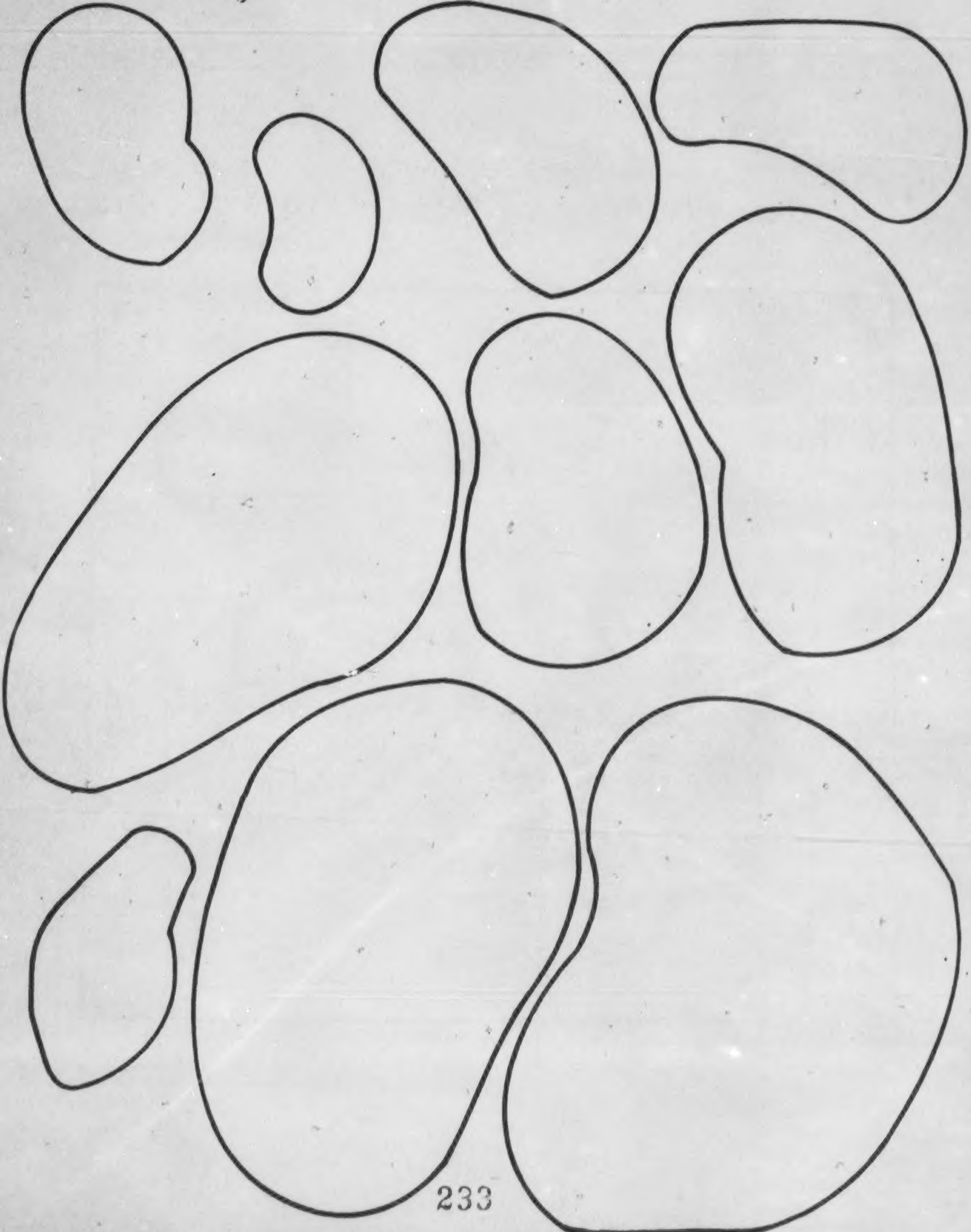
Name ____________________

Find the longest line.
Find the shortest line.
Find the lines that are the same.



F-40

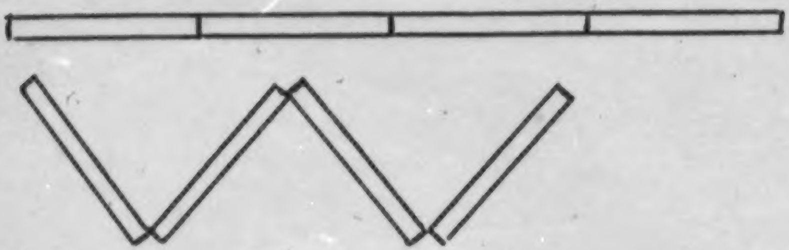
Cut these beans out. Put them in order from largest to smallest.



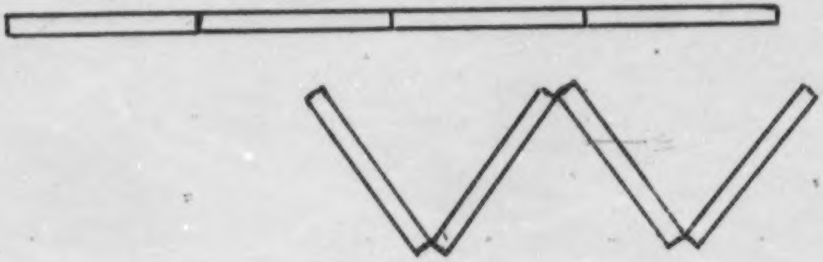
Name ____________________

Are the paths in each problem the same length?

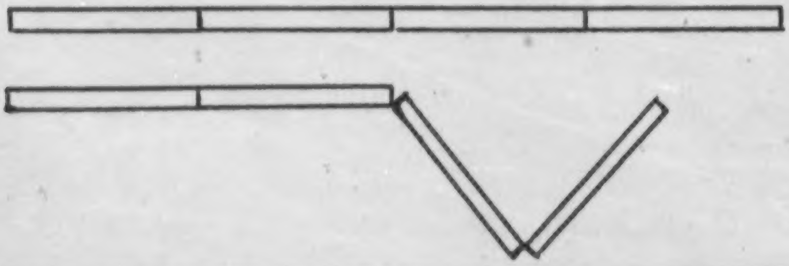
A.



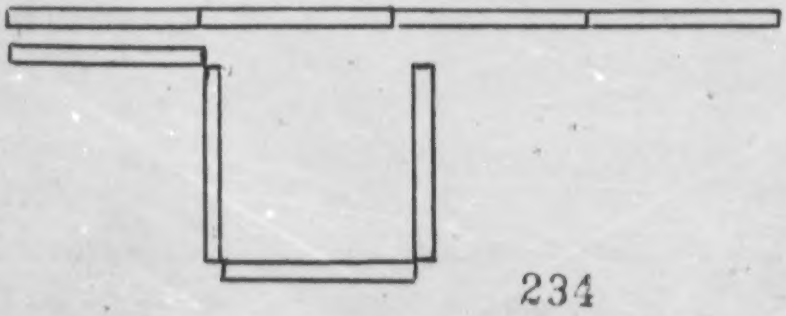
B.



C.

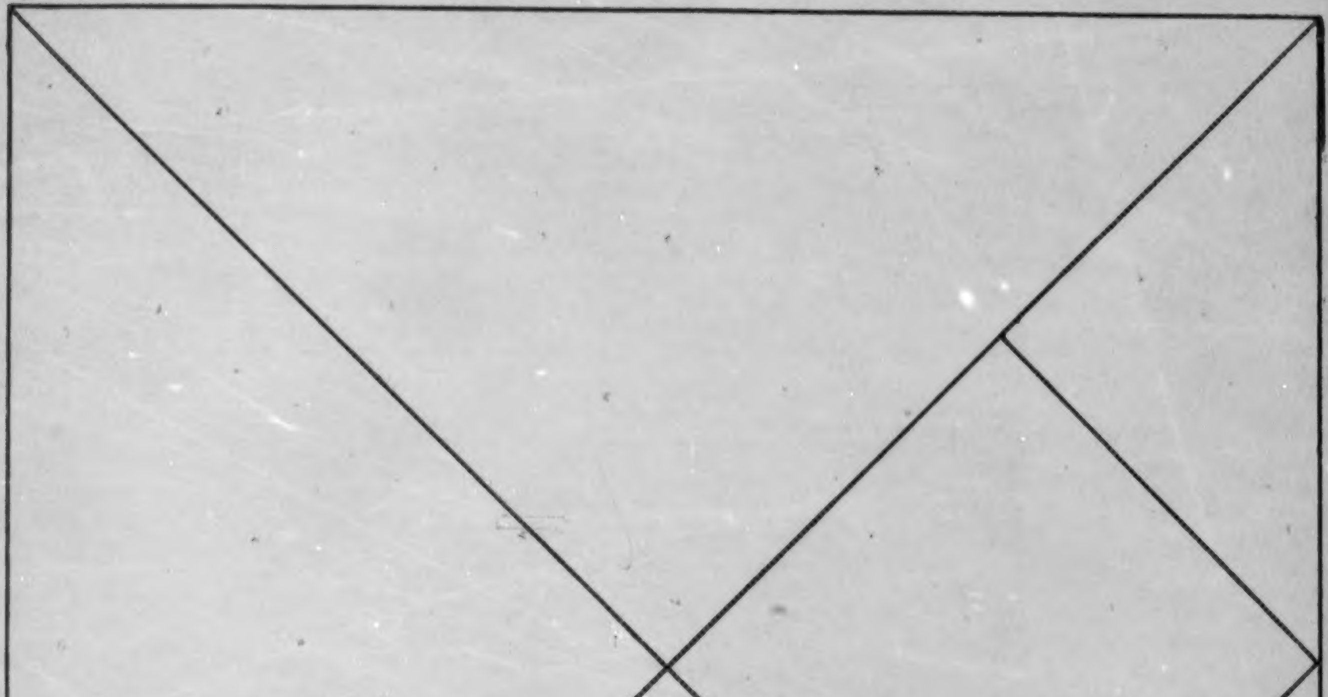


D.



Name. ______________________

Cut out along the heavy lines.
Find the shapes that fit or top of
each other.



Name ____________________

How many of each thing on the list will weigh about the same as the apple?

________ Wooden blocks

________ Nails

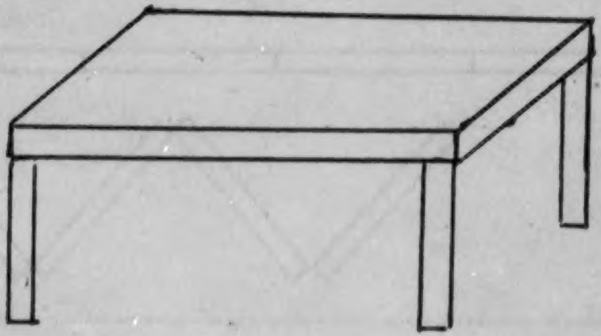
________ Nuts and bolts

________ Metal washers

________ Marbles

Name ____________________

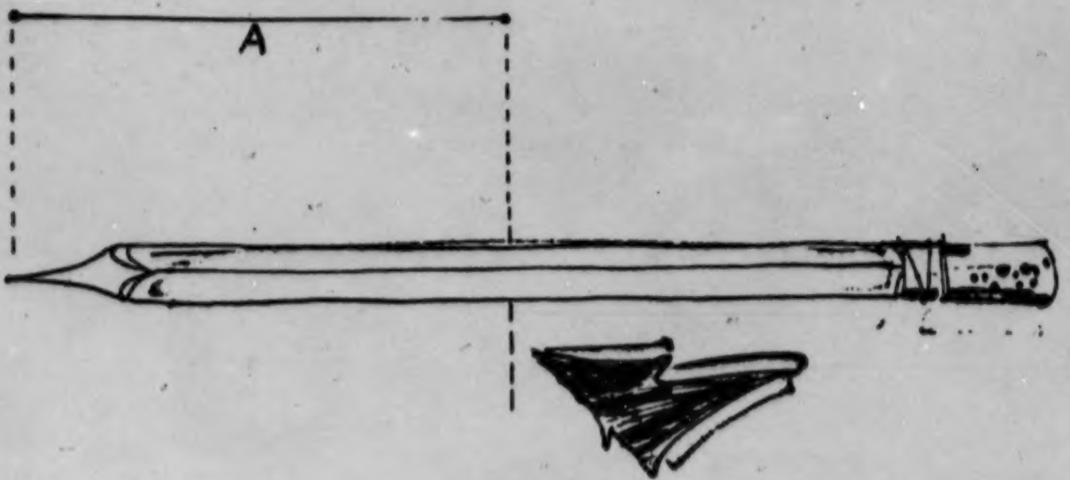
This is a picture of a table.



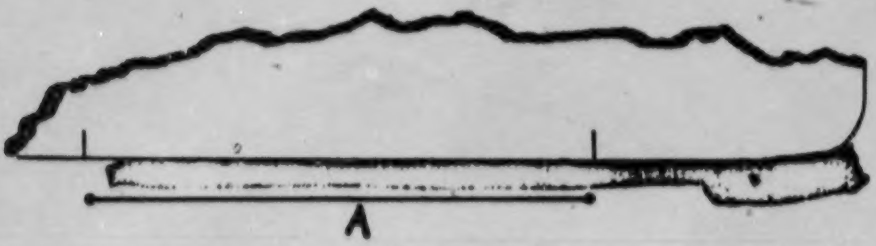
Dran an arrow on every part you could measure.

Name ____________________

Use your pencil to measure line A.

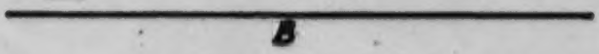


Or tear a strip of paper to use as a model of line A.

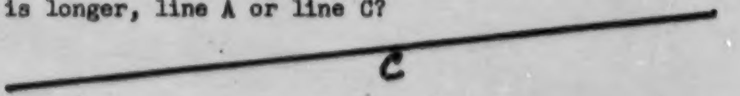


NOW ANSWER THESE QUESTIONS:

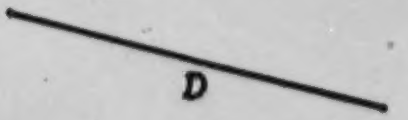
1. Which is longer, line A or line B?



2. Which is longer, line A or line C?



3. Which is shorter, line A or line D?

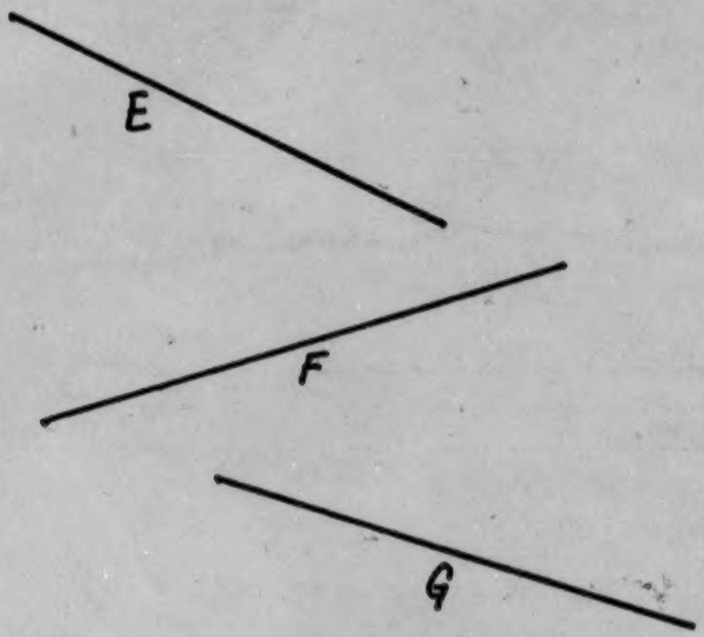


Name ______________

4. Which is shorter, line A or line E?

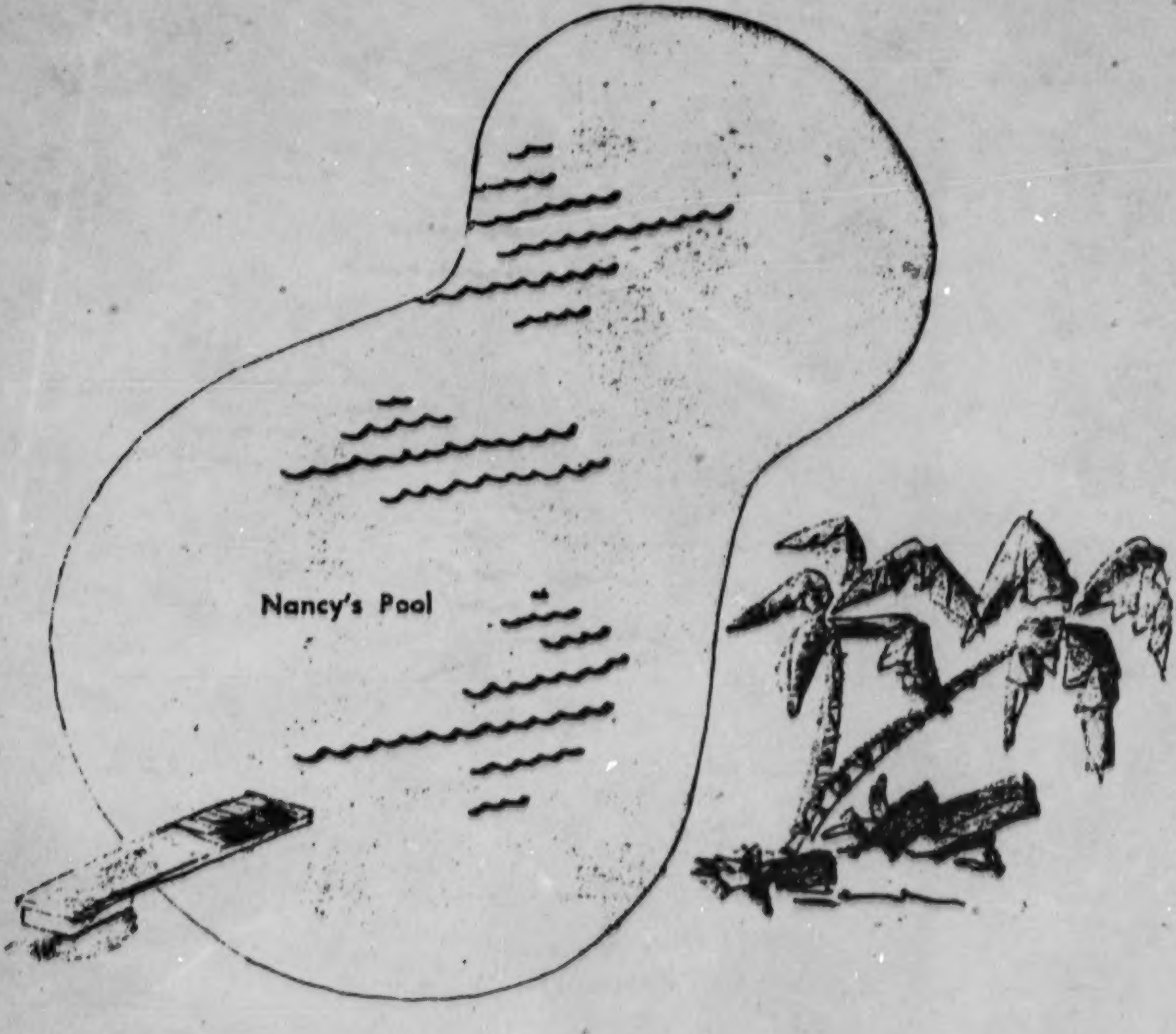
5. How do line A and line F compare?

6. Compare line a and line G. Which is longer?



MEASURING AREA Name ____________

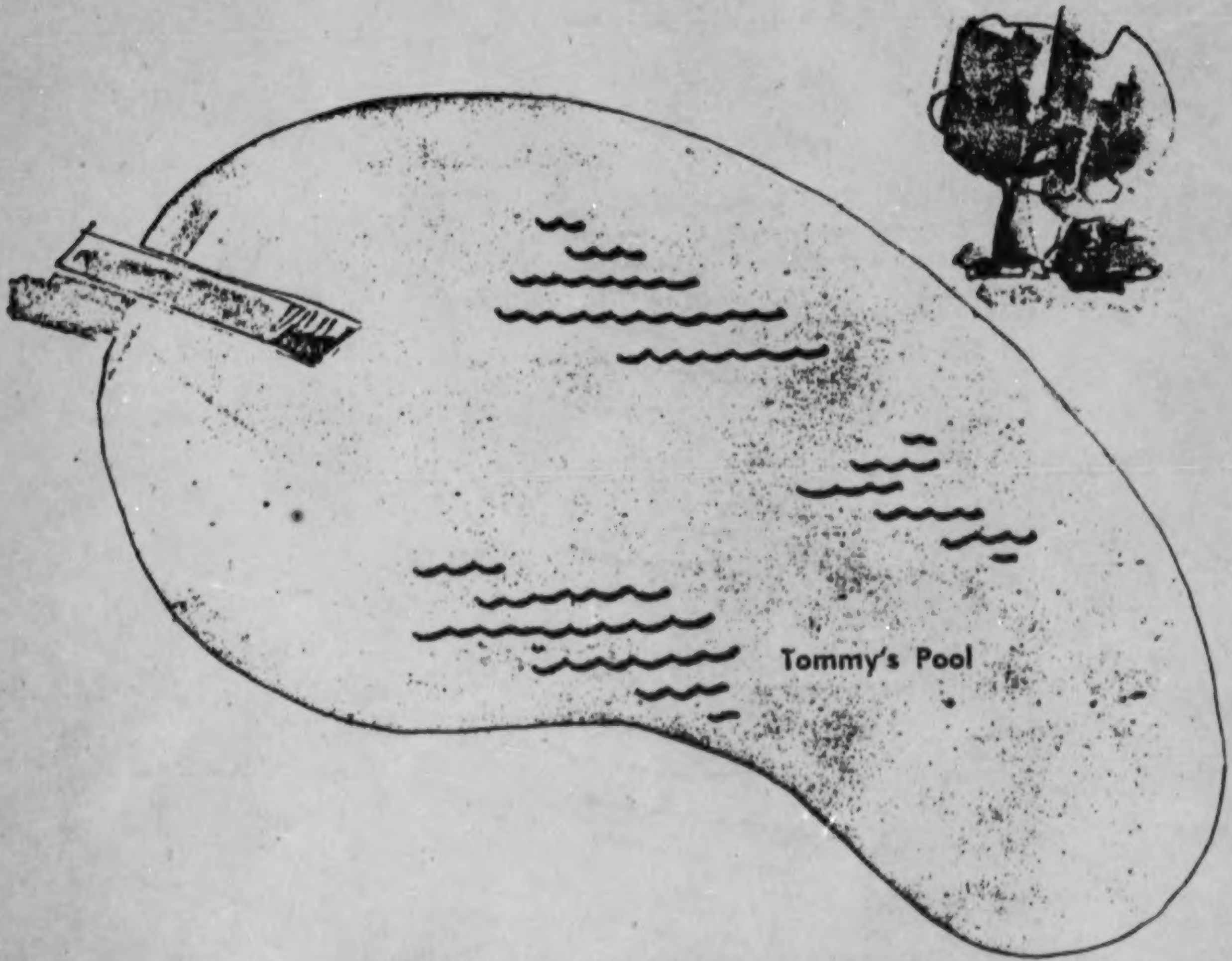
On this page and the next one are two pictures of swimming pools. One is in Nancy's yard and one is in Tommy's yard. Which pool has more room for swimming?



The pool with the most room for swimming has the greater area.

Name ____________

How can we find out which pool has more area?



1. Start with a big pile of pennies. How many pennies will it take to cover each pool?
   Cover both pools and then count the pennies.
   Which pool holds more? Compare your answers with your neighbor's answers.

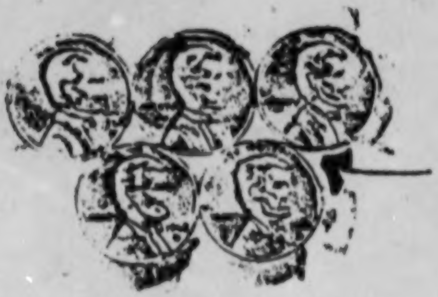
Name ______________________

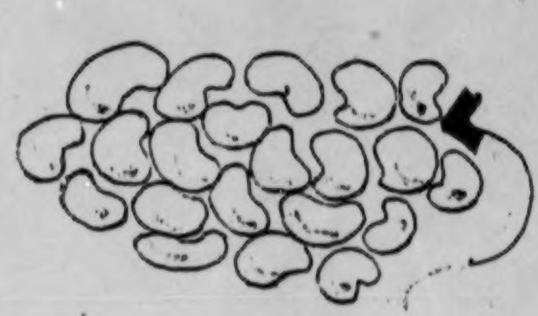
2. Now cover the pictures of the pools with beans, bingo markers or checkers.

Compare your answers with your neighbor's.

Could the units of measure you are using be better? How?

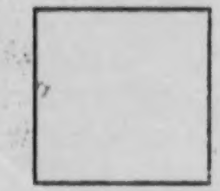
Do pennies or beans cover the whole surface of the pools?



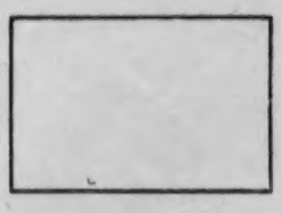


What shape unit might be better than pennies or beans?

A Triangle?



A Square?



A Rectangle?

Which would be easiest to use?

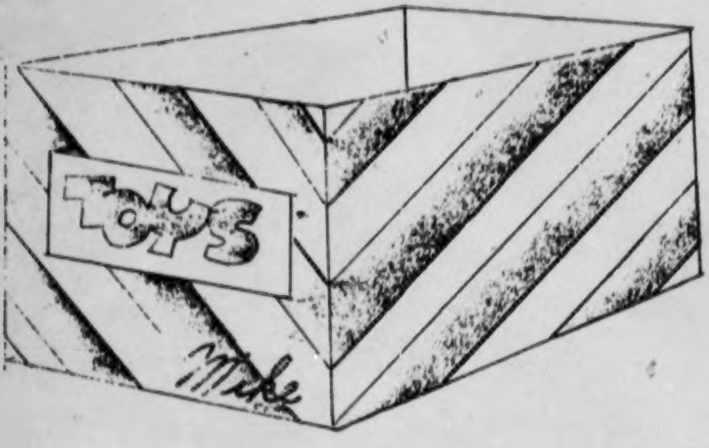
Let's experiment. Cut paper into many equal-sized squares to cover the pools. What about spaces too small to fit a whole square?

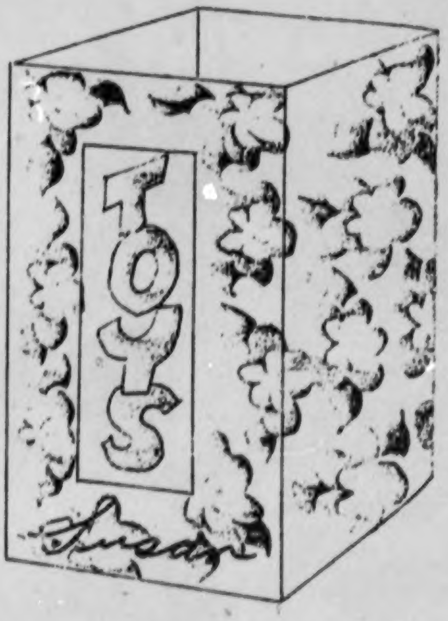
F-50

Name ________________

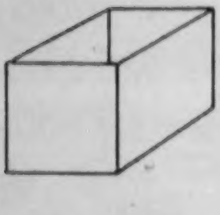
VOLUME

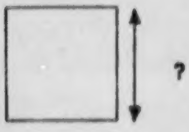
Mike and Susan each have a box for their toys.

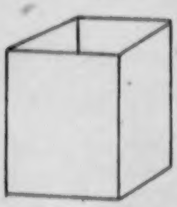


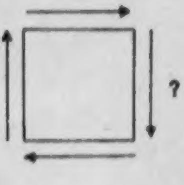


1. How would you find how **tall** (deep) each box is?
   How long each is?
   How wide each is?
2. How would you find the distance **around the top?**



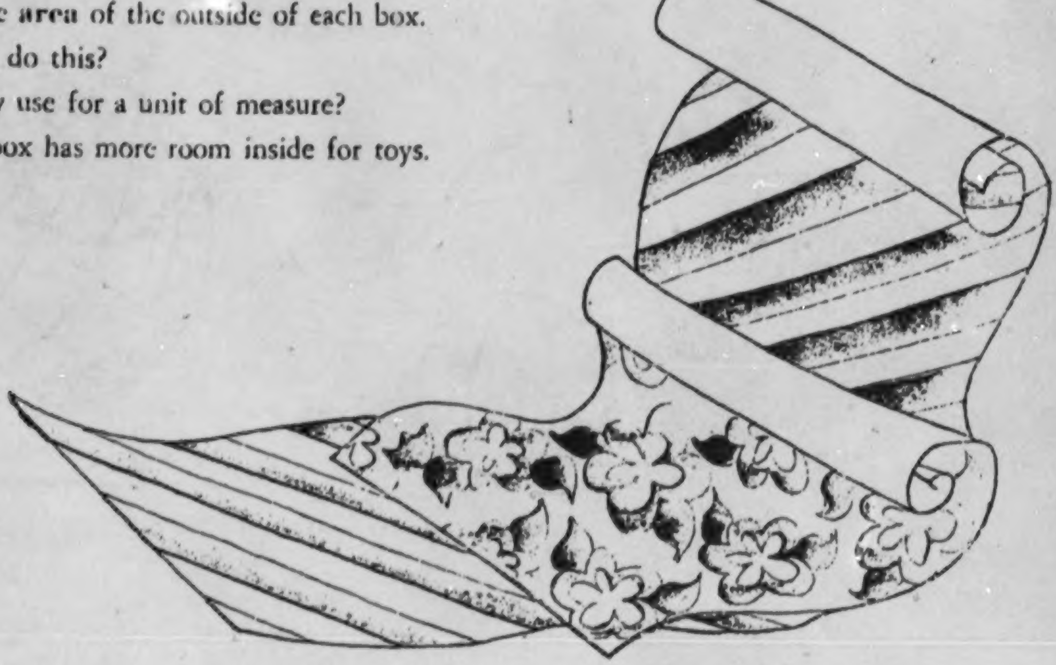




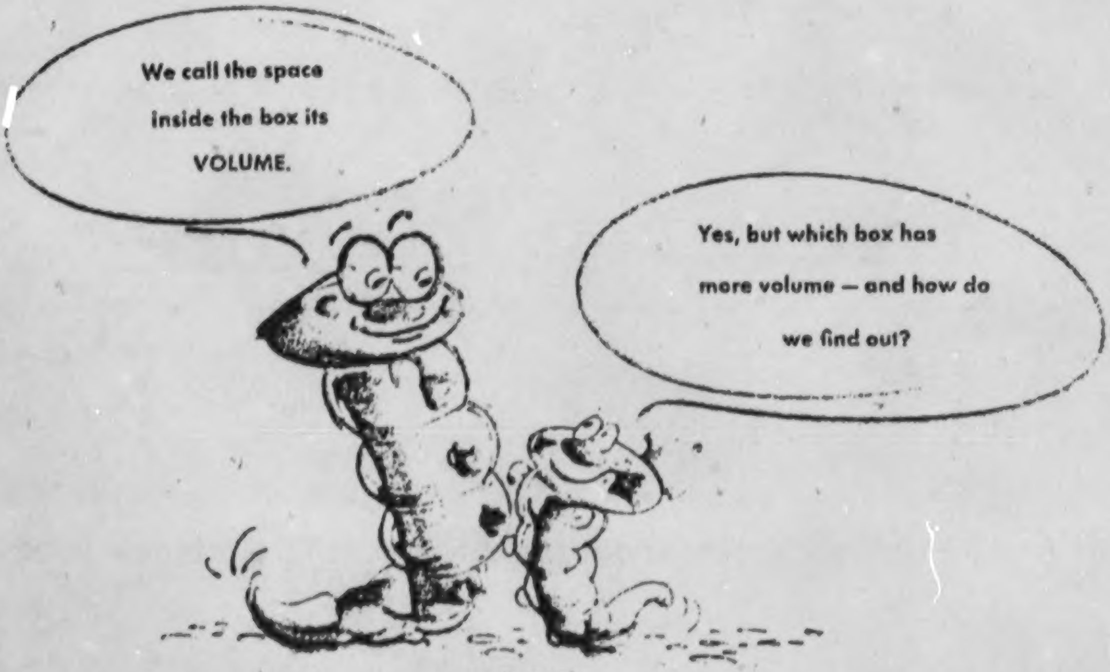


Name ______________

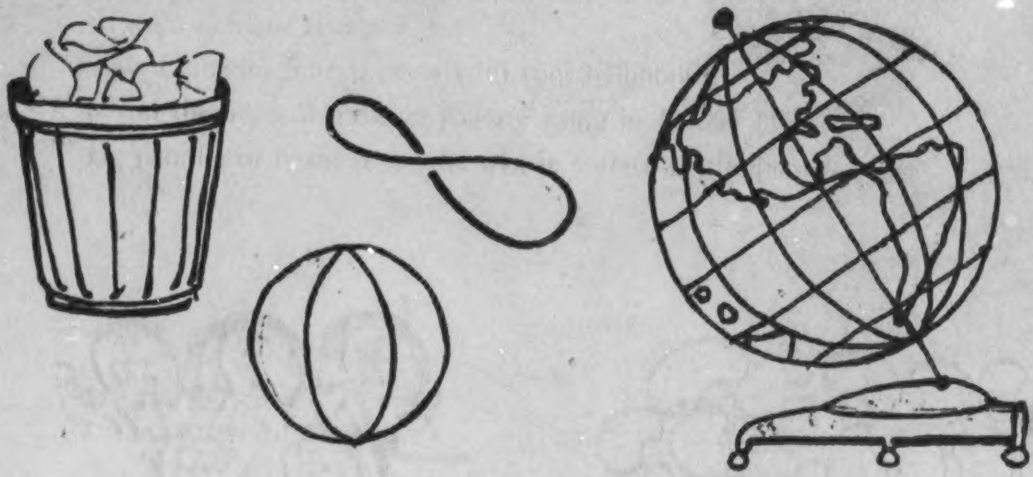
5. Mike and Susan covered their boxes with wallpaper. They had to find the area of the outside of each box.
How did they do this?
What did they use for a unit of measure?
Guess which box has more room inside for toys.



Mike thinks his box will hold more toys because it is bigger around the top?
Susan thinks hers will hold more toys because it is deeper.


We call the space inside the box its VOLUME.
Yes, but which box has more volume — and how do we find out?

MEASURING CURVES



How would you measure these lines and shapes?

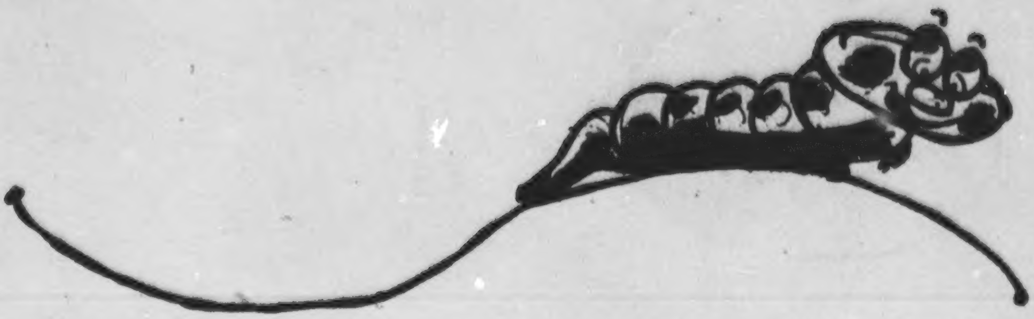
Could you use a ruler? ____________

Could you use a string? ____________

Cut a piece of string 1 metre long. Lay it along the curve you want to measure.

Then straighten it out and measure just the part you used.

Guess the length of this line.



Now use your string to measure it. Straighten the string and check the length with a ruler. ______________

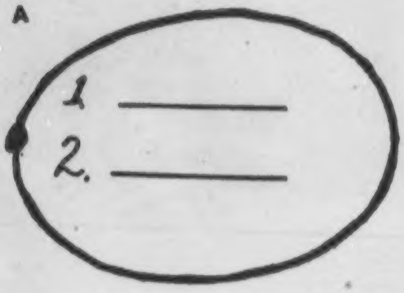
How close did you come? ______________

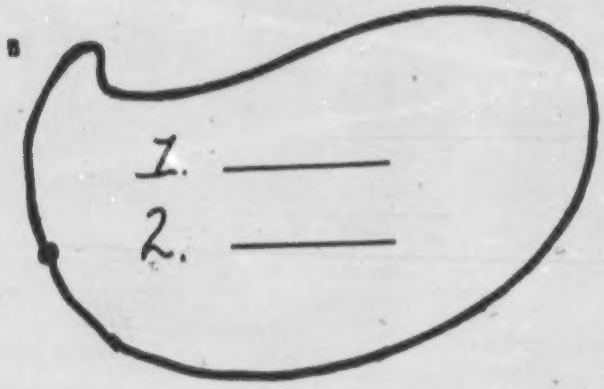
Find other things in the room to measure. Estimate your answer first. Then measure.

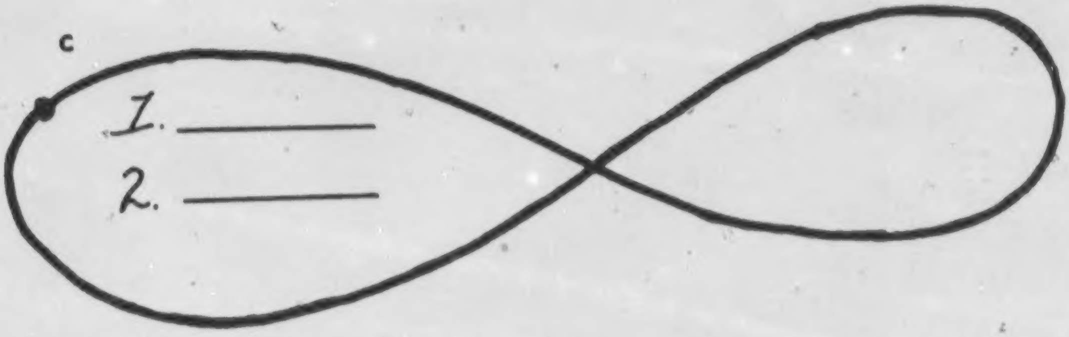
1. a globe ___________ ______________
2. a wastebasket ___________ ______________
3. ___________ ______________
4. ___________ ______________
5. ___________ ______________

Have a friend check your measurements to see if they are accurate.

Look at the figures marked A, B, and C. Guess how far it is around each figure. Write your guesses on line number 1.







Now use your string and ruler to measure all these figures. Write the measurement on Line 2.

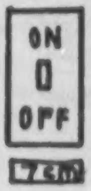
Check to see how close you came. Compare your answers with your neighbor's.

MEASURE HUNT

Choose a colored paper strip.

Find something in the room the size of the strip.

Tape the strip by the thing.



7 cm

5cm

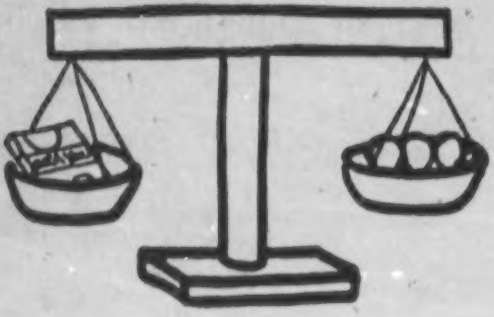
18 cm

4 cm

6 cm

HANG TEN

Use 2 nickels for 10 grams.



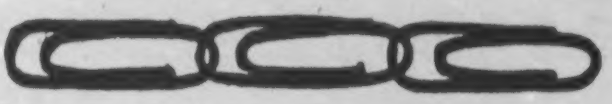
1. Put something light in the balance.
2. Make a 10 gram weight out of clay.
3. Make as many weights as you need to balance it.

1.Draw a picture or write what you found out.

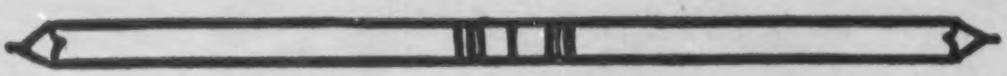
☆Which is heavier, 3 pencils or two 10 gram weights?

WHICH IS LONGEST?

- A chain of 10 paper clips



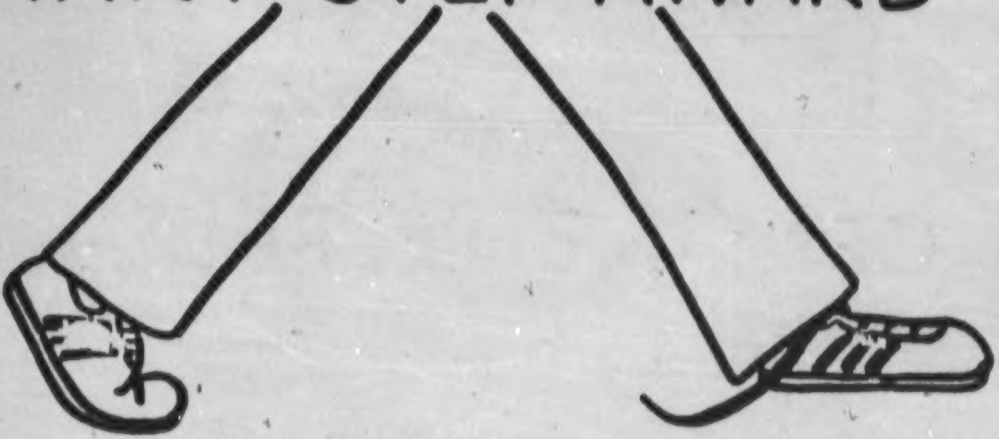
- Two pencils end to end



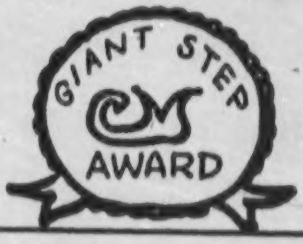
- 24 centimetres

List from short to long.

GIANT STEP AWARD



Measure the GIANT step of 5 friends.

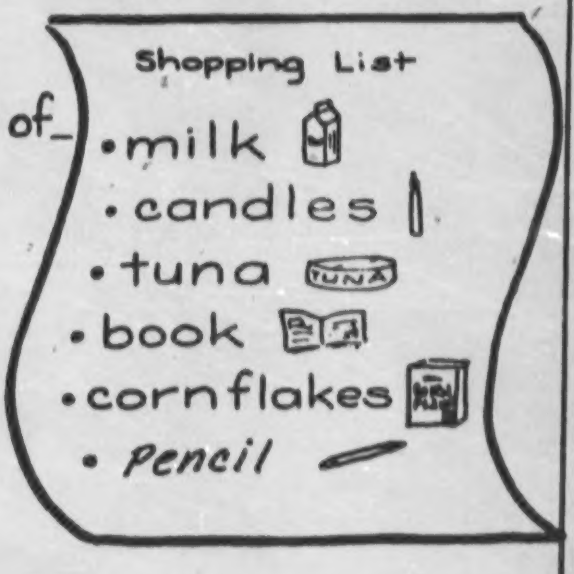
Make a pin  for the winner.

GIANT STEP
AWARD

SHOP METRIC

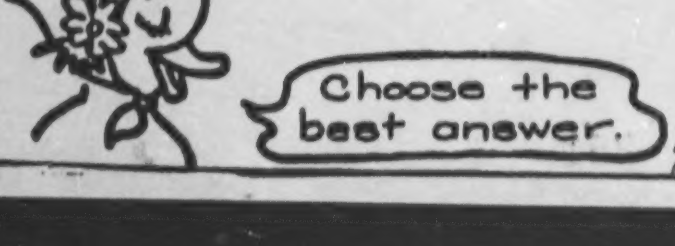
You are going to the store.
You will get:

1. One box (340 grams) of_
2. Two litres of_
3. A 200 gram can of_
4. One *decimetre of*–
5. Two 25 - centimetres long -

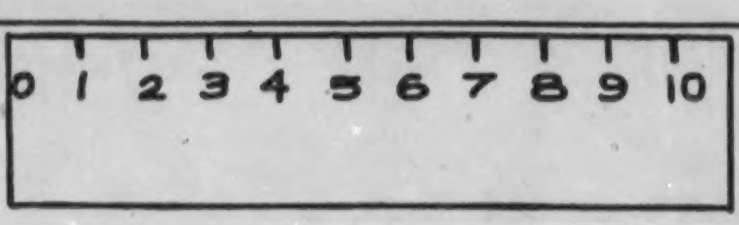


Shopping List

- milk
- candles
- tuna
- book
- cornflakes
- *Pencil*

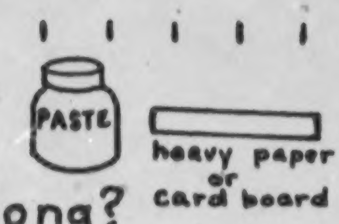


Choose the best answer.


0
1
2
3
4
5
6
7
8
9
10

CENTIMETRE RULER

Cut a piece of paper 11 cm long.
Mark the centimetres.
Paste it on heavy paper.
What can you find about 10 cm long?

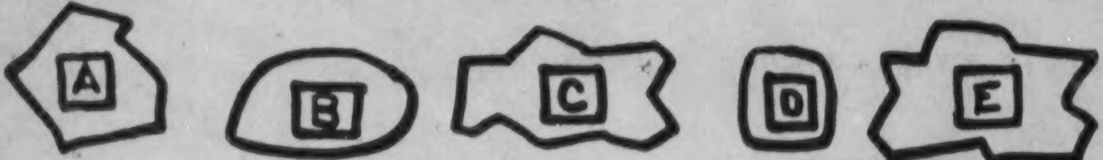

PASTE
heavy paper
or
card board

THE SNAIL

Find
5 things
less than
10 centimetres.

HOW MANY GRAMS ?

Get 5 rocks. Label them.



Put them in order by weight.

Start with the lightest.

Use your gram scale to check.

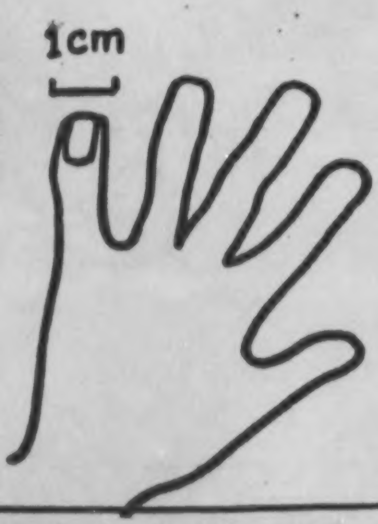
Write the letters in order.

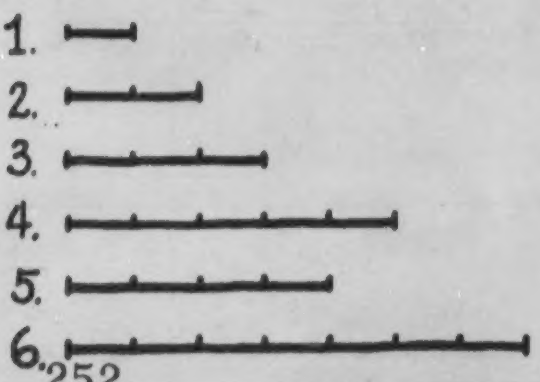
Why not try 5 books, potatoes, or some other things ?

FINGER MEASURE

Your little finger is about 1 centimetre wide.

Use your finger to tell how wide this is :





USE A STRAW

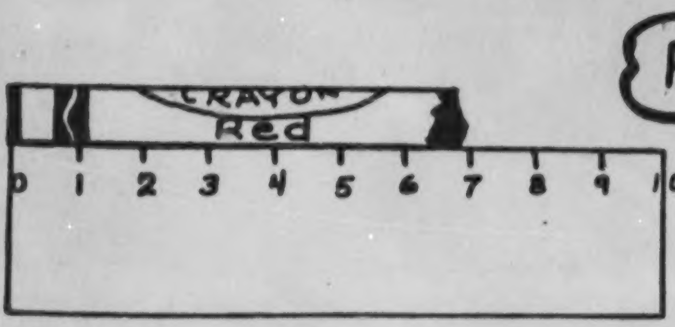
Cut it one centimetre long.
Measure the lines:

1. ________________ ☐ 4cm
2. ________ ☐
3. ________________________ ☐
4. ____________________________________ ☐

Maybe you can string 10 straws together to measure longer lines.

LINE UP

Measure 5 different crayons in centimetres.


CRAYON
Red
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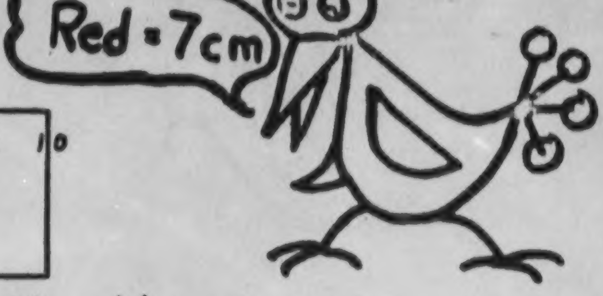
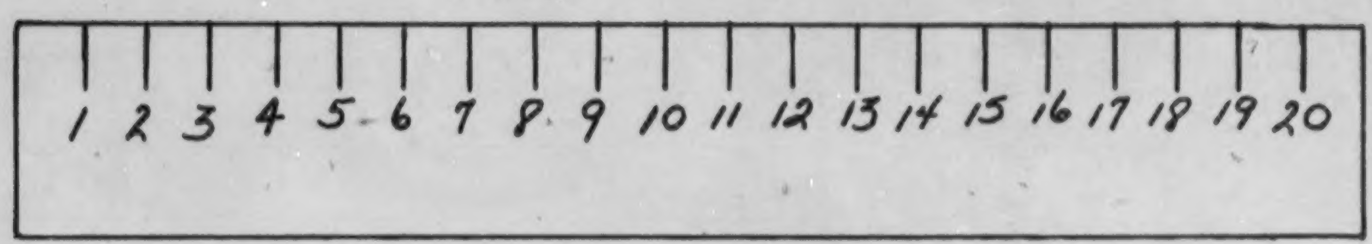


Line up the ruler with the zero at one end of the crayon.

F-61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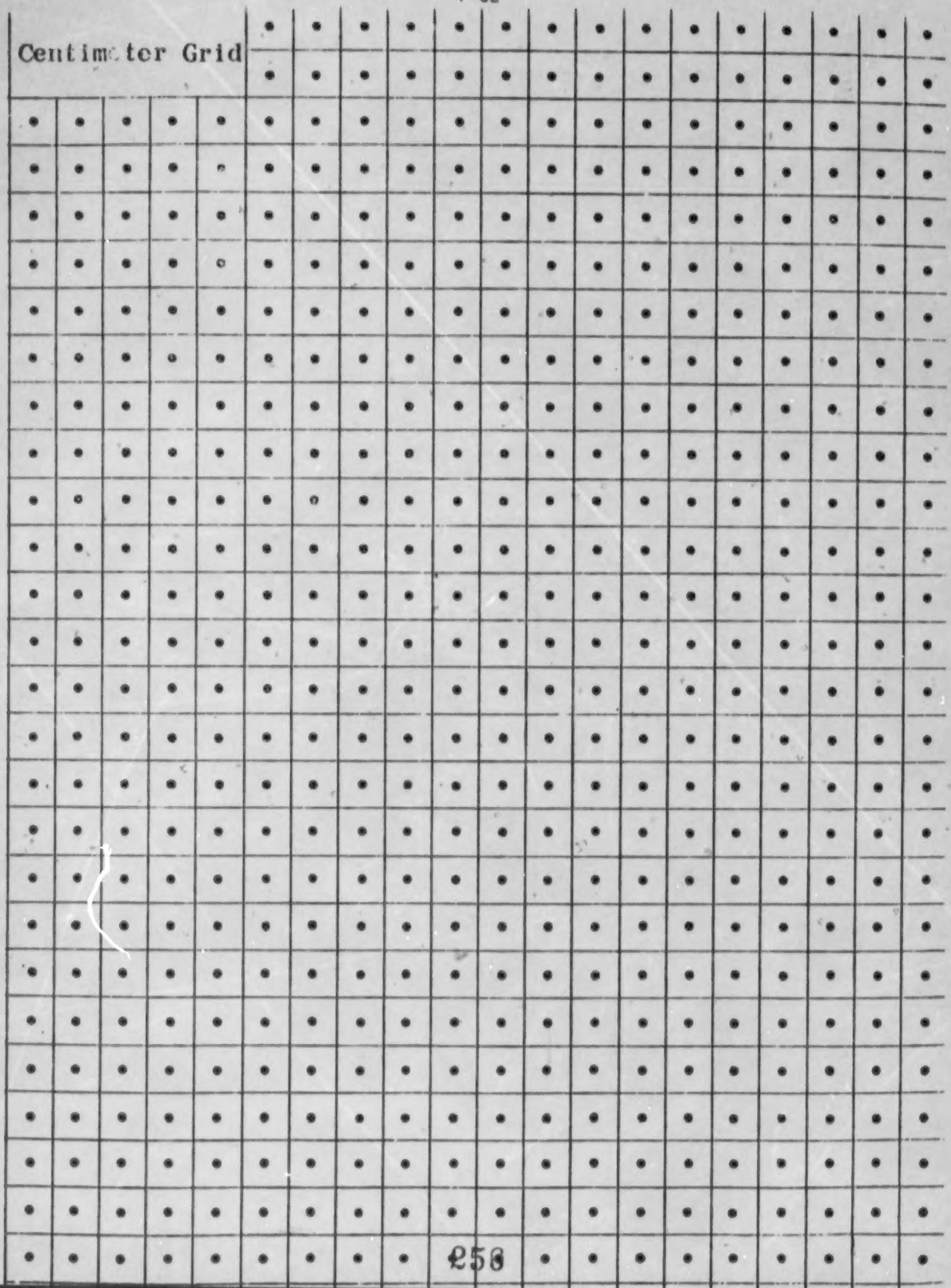
Centimeter Grid



APPENDIX G

TEST GIVEN AS PRETEST
AND POST TEST FOR THE
FIFTH GRADE ETU IN READING

E.T.U. PRETEST

Name:____
(first) (last)

School:____

Teacher's Name:________________________________

Part I

INSTRUCTIONS:

In the following sentences or paragraphs, something has been left out. Below each blank are some choices of words to fill the blank. More than one word might make sense in the blank. CIRCLE any word which would make sense in the blank.

Example: Mary worked hard on her English ______________.

a. story

b. composed

c. paper

d. experiment

1. We burn ______________ in our furnace.

11. coal

12. plastic

13. wood

14. candles

2. The little mountain stream was full of ________________.

15. trout

16. running

17. beavers

18. clear

3. All at once, the big jungle ______________ streaked out of the tall grass. It snarled as it came in mighty bounds. The elephant trumpeted her alarm. She wheeled to meet the charge, but her great weight made her much too slow. With a savage leap the tiger was upon her, ripping with its claws, slashing her back with yellow fangs.

19. snake

20. elephant

21. tiger

22. cat

4. Many vegetables need to have fertilizer put into their soil to make them grow big and tall. But root vegetables, like radishes, are different. Since we eat the ______________ part of these vegetables, we do not want to grow big tops above the ground and no roots beneath. So we do not fertilize these plants.

23. top

24. bottom

25. root

26. outside

STOP!

Part II

INSTRUCTIONS:

In the following sentence or paragraphs there is one word which is the best choice to fill the blank. CIRCLE one word for each blank.

Example: John went to the ___(A)___ to ___(B)___.

(A)	(B)
school	swim
pool	sleep
store	laugh

1. Pam will ___(27)___ the ___(28)___ before she adds the milk.

(27)	(28)
sift	apples
stir	cheese
run	flour

2. I ___(29)___ myself on the bathroom ___(30)___.

(29)	(30)
sat	wall
wrote	scale
weighed	mirror

3. The village is high up in a steep, narrow valley. Where the land is flat enough to be plowed, neat little fields are marked off. The men have ___(31)___ potatoes, oats, and rye. At the edge of the fields, the sides of the valley slope gently upward. These slopes are too steep to ___(32)___ so grass is grown here.

(31)	(32)
eaten	plow
wanted	climb
planted	reach

STOP!

Part III

INSTRUCTIONS:

In these sentences or paragraphs there is still one word which is the best choice to fill the blank. But this time think about what words in the sentence or paragraph helped you decide what to choose for the blank. CIRCLE the word which fits best in the blank ,then CIRCLE any words which helped you decide what to use for the blank.

Example: The unhappy little girl _________ as loud as she could.

cried
laughed
whispered

1. The __(33)__ lived in the royal palace with her father.

(33) 35 36
sister
princess
prince

2. The sailors are readying their __(34)__ for winter storage.

(34) 37 38
soaked
plane
boat

3. On the day of the battle the two teams began to fill their places. When all were ready, a horn was ____(39)____ . Each team raced its horses forward. As they met with a crash like ____(40)____ horses fell into pieces. The knights fought on with their swords.

(39)	(40)	42	43
yelled	tingling		
blown	lightening		
bought	thunder		

4. In the old days, fire engines were drawn by horses. When the fire alarm sounded, each horse sprang to its place. Its harness hung ready above its back. Meanwhile, firemen slid down the new "sliding pole" and ran to the horses. Each harness was lowered and fastened. Firemen scrambled to their places. The eager horses tugged at the heavy ____(41)____ . At the bell's clang, they galloped out of the open door to the fire.

(41)	44	45
engines		
firemen		
buggy		

STOP!

G-7
Part IV

INSTRUCTIONS:

In these last sentences or paragraphs, make up your own word which makes sense in the blank. Write your word in the blank. Then CIRCLE any words that helped you decide what to use for the blank.

Example: The dog ____________ at the boy.
c

1. Because the ocean roars, we need to ______________ to be heard. 57
46

2. Elizabeth's present was ______________ very beautifully. 58
47

3. My room is __________ because it is too __________ from the heater. 59
48 49

4. The carpenter ______________ the ______________ together. 60
50 51

5. One day grandfather saw a little old man. He was eating his lunch--
a slice of bread, a bit of meat, and a cold potato. Because it seemed
so poor a lunch, Grandfather went back to the house and brought two big
apples. The old man thanked him and ate the ______________. 61
52

6. A whistle blew. Pounding feet came to a stop. The players took their
positions for a foul shot. There was a hush as the ______________ 62
53
soared through the air. It thumped against the backboard and swished
through the basket. Cheers arose from one side of the gym, and groans
from the other. The two teams then trotted back to their places.

7. At first the trip was pleasant. But when the ship reached the ocean
beyond Gibralter, a storm arose. Huge ______________ broke over 63
54
the decks of the ship. Ansaldo and his sailors thought that the ship
would surely go under. But at last the ____________ broke through 64
55
the clouds, and they sighted an ______________ in the distance. 65
56

STOP!

Part V

INSTRUCTIONS:

Read each sentence below and note the underlined word. Then read the words or phrases below the sentence and CIRCLE the one that means the same as the underlined word.

11. The sun was shining brightly through the window making the room quite cheerful in the early afternoon.

    dark

    pleasant

    crowded

12. Jack was doubtful about going to the picnic with his friends. He might have to stay home and work.

    sure

    glad

    uncertain

13. The boy walked up to the horse, mounted it quickly, and rode away before anyone was able to stop him.

    got off

    caught sight of

    got on

14. The fierce fire raged for hours and did much damage to the buildings before the firemen were able to put it out.

    smoldering

    violent

    controlled

15. The fireman's daring saved many lives. He risked great danger running into the burning building to bring people out.

    boldness

    hesitation

    pride

STOP!

Part VI

INSTRUCTIONS:

Read the sentence in the box. Then read the sentences below the box. If a sentence means the same thing as the sentence in the box, CIRCLE "SAME". If any part of the sentence means something different from the sentence in the box, CIRCLE "DIFFERENT".

Example

John ran quickly up the street.

A SAME DIFFERENT John ran up the street quickly.

B SAME DIFFERENT John raced quickly up the street.

C SAME DIFFERENT John ran slowly up the street.

1. For many years Frank Buck had wanted to capture a man-eating tiger.

16 SAME DIFFERENT To catch a man-eating tiger had long been Frank Buck's wish.

17 SAME DIFFERENT For many years a man-eating tiger had wanted to catch Frank Buck.

18 SAME DIFFERENT For many years Frank Buck had longed to see a man-eating tiger.

19 SAME DIFFERENT Frank Buck had wanted for a long time to capture a man-eating tiger.

2. The teacher sends a note home sometimes.

20 SAME DIFFERENT The teacher sends a sometimes note home.

21 SAME DIFFERENT Sometimes the teacher sends a note home.

22 SAME DIFFERENT The teacher sometimes sends home a note.

23 SAME DIFFERENT A note sends the teacher home sometimes.

3. Children raced across the streets on their way home, not caring at all about the traffic.

24 SAME DIFFERENT Children ran across the streets on their way home, not caring at all about the traffic.

25 SAME DIFFERENT Children raced across the streets on their way home, not paying attention to the traffic.

26 SAME DIFFERENT Children raced across the sidewalks on their way home, not caring at all about the traffic.

27 SAME DIFFERENT Children raced across the streets on their way home, not looking at all for cars.

4. The little colt was wild-eyed with fear, for straight at him came the great, gray wolf.

28 SAME DIFFERENT Because the great, gray wolf came straight at him, the little colt was very frightened.

29 SAME DIFFERENT Straight at him advanced the huge, gray wolf, because the colt was wild-eyed with fear.

30 SAME DIFFERENT When the great, gray wolf moved forward, the little colt was filled with fear.

31 SAME DIFFERENT The colt was frightened because a wolf was coming closer.

5. A red fox family on a single hunt may catch eight pounds or more of mice and rabbits.

32 SAME DIFFERENT On a single hunt, a red fox family sometimes catches eight pounds or more of rabbits and mice.

33 SAME DIFFERENT Eight pounds or more of mice and rabbits may catch a red fox family on a single hunt.

34 SAME DIFFERENT Eight or more red foxes on a hunt sometimes catch a single family of mice or rabbits.

35 SAME DIFFERENT As many as eight pounds or more of mice and rabbits may be caught by a red fox family on a single hunt.

STOP!

Part VII

INSTRUCTIONS:

Rewrite the sentence. Keep the same meaning. Change or rearrange anything that's in the box.

In a flash	the fight would be	all over.

36. ____

____

WRITE it another way.

37. ____

____

REWRITE the sentence. Keep the same meaning. Change or rearrange anything you want.

When Kate fell, the lantern smashed and the light went out.

38. ____

____

WRITE it another way.

39. ____

____

STOP!

Part VIII

INSTRUCTIONS:

Read the story carefully. After the story are two kinds of questions.

> The Bulldog fans were worried. The score was tied in the last minute of an important basketball game. Suddenly one player saw an opening. He ducked through and took a shot at the basket. The ball bounced on the rim then dropped through the basket. Cheers arose from one side of the gym, and groans arose from the other side. The Bulldogs had won the game.

The first question asks you to decide what the story is mainly about. There are 4 choices. Circle the number of the phrase that tells best what the story is mainly about:

A. This story is mainly about:

1. why the Bulldog fans were worried
2. how the Bulldogs won the game
3. when the Bulldogs tried a foul shot
4. why the referee blew the whistle

After the question are some sentences. If the sentence means the same thing as part of the story, circle the word "SAME." If any part of the sentence means something different from the information given in the story, circle the word "DIFFERENT."

B. SAME DIFFERENT There was a shot during the last minute of the game.

C. SAME DIFFERENT The Bulldogs scored on the shot.

D. SAME DIFFERENT Everyone was happy when the ball went through the basket.

Read the story carefully. After the story are two kinds of questions.

Today most people wear masks for fun. But masks have not always been something that people wear on holidays or to parties. Museums all over the world are filled with masks that have been used by warriors and by hunters.

A helmet is a kind of mask. Soldiers going to fight have often worn helmets to protect their heads. But sometimes the helmet - mask had another use. Japanese warriors wore helmets that were made to look as mean and ugly as possible, so that the enemy would be too scared to attack.

The Eskimos of Alaska use masks in a hunting ceremony. They make wooden masks to look like the spirit of the animal they wish to hunt. The Eskimos wear these masks at a ceremony before going hunting. They believe these "spirit" masks will make the animal let itself be hunted and killed.

40. This passage is mainly about:

    1. how masks have been used by warriors and by hunters
    2. why Eskimos wear "spirit" masks
    3. what masks are kept in museums around the world
    4. why children wear masks

41 SAME DIFFERENT Soldiers wear helmet-masks at a ceremony before the fight.

42 SAME DIFFERENT The Eskimos wear spirit masks so they will be lucky in the hunt.

43 SAME DIFFERENT The helmets worn by Japanese warriors were decorated with beautiful designs.

Read the story carefully. After the story are two kinds of questions.

One type of food with a really interesting name is the hot dog. At first this sausage was called a dachshund sausage, because it was long and thin, like the dachshund dog. The dachshund sausage got its new name when it was first served at a baseball game in the year 1900. On the day of the game the weather was cold. Food vendors knew that people would want something hot to eat. So they served dachshund sausages, which they kept hot in tubs of boiling water. The chilled baseball fans enjoyed the steaming sausages. So the vendors kept on serving dachshund sausages at baseball games. "Hot dachshunds," they would call, to tempt people to come and buy. But they had trouble spelling dachshund when they wanted to make signs. So pretty soon they started using an easier name -- hot dog. That's how the hot dog got its name.

44. This story is mainly about:

    1. what an interesting name the hot dog has
    2. how the hot dog got its name
    3. when hot dogs were first eaten
    4. why hot dogs are sold at baseball games

45. SAME DIFFERENT The hot dog used to be called a dachshund sausage.

46. SAME DIFFERENT The hot dog was a special favorite on hot days at baseball games.

47. SAME DIFFERENT The name was changed from dachshund sausage to hot dog because hot dog was easier to say.

Read the story carefully. After the story are two kinds of questions.

You are in an airplane. The pilot announces that he is leveling off at 15,000 feet. You can see miles of blue sky and big puffs of clouds here and there. The ground below looks green and brown. The jumpmaster gives you a signal. You leap out of the plane -- into the blue sky.

Now you are alone in the sky. There is no noise. There is just a gentle swishing in your ears. You do not feel as if you are falling. But, of course, you know that you are falling.

After you have fallen for 75 seconds, you pull the rip cord. Your parachute spurts out above you. You float gently down to the ground. As you reach the ground, you bend your knees. You roll gently into the fall, tumbling over and then onto you feet. Quickly you pull in your parachute. You have felt for the first time what a skydiver feels as he engages in an unusual and dangerous sport.

48. This story is mainly about:
    1. what things look like from up in the air
    2. what to do if you fall out of an airplane
    3. why skydiving is dangerous
    4. how it feels to be a skydiver

49. SAME DIFFERENT You can feel yourself falling through the air.

50. SAME DIFFERENT Right after you jump, the parachute opens up.

51. SAME DIFFERENT When you hit the ground, you roll gently to break the fall.

Read the story carefully. After the story are two kinds of questions.

How would you like to take medicine made from these things: a pinch of gold dust, a spoonful of ashes of a dried lizard, some burned cat's hair, and two mashed onions? Many years ago if you had a stomach ache, the doctor might have given you a medicine made of such things. The worse the medicine tasted, the better it was supposed to be for you.

Not all the old recipes for medicine were quite as bad as this one. Many medicines were made from parts of plants. Some were made of ground-up tree bark and leaves. Others were made of berries and seeds, or roots and flowers. One medicine used by the eye doctor was even made from a poisonous weed called deadly nightshade.

52. This story is mainly about:

1. how medicine used to taste
2. what doctors can do with deadly nightshade
3. why medicines were made from plants
4. what things medicine used to be made of

53. SAME DIFFERENT Long ago they thought that all medicine should taste good.

54. SAME DIFFERENT Many medicines were made from parts of plants, like leaves and flowers.

55. SAME DIFFERENT Even poisonous plants can be used to make medicine.

If you finish early, try this just for fun.

NAME AS MANY STATES AS YOU CAN.

APPENDIX H

TESTERS MANUAL FOR
ADMINISTRATION OF THE
PRETEST AND POST TEST
ACCOMPANYING THE FIFTH
GRADE ETU IN READING

TESTER'S MANUAL

Experimental Teaching Unit

Reading - Grade 5

General Information

At the beginning of the test session, give the teacher a copy of the test. Say something like "YOU MIGHT WANT TO LOOK THROUGH A COPY OF THE TEST." Let the teacher keep the test during the test session, but be sure to get the test back at the end of the session. Do not let the teacher keep a copy of the test. Explain to the teacher that the Unit should cover this general area of reading skill rather than the specific items on the test. Point out that the Materials pages in the Unit are very similar to the test items.

During the testing, it will be necessary to circulate around the room, making sure that students have understood the directions correctly. A student who is confused may raise his hand for help. If this happens, repeat the instructions to the child. You may point out to him where he is supposed to read and mark. But do not help him answer the questions. And do not read any words for the child.

The teacher may want to help circulate and answer questions. This is permissable as long as the teacher understands that he may only repeat the instructions and may not read words for the child or try to explain the task more clearly.

Some children at lower reading levels will find the exercises frustrating. Try to encourage such children to figure out what they can. Say something like:

> I KNOW SOME OF THE QUESTIONS ARE DIFFICULT. YOU ARE HELPING US FIND OUT WHICH THINGS ARE HARD TO DO. TRY TO FIGURE OUT WHATEVER YOU CAN ON YOUR OWN.

This is not a timed test. Ideally, all students will have enough time to finish. Sometimes there are slow readers who hold up the rest of the class. If this happens, wait a reasonable length of time, then go on. It is important to keep things moving along, so that the rest of the class doesn't become restless, and so that very slow readers aren't frustrated by trying to do the impossible. Use your judgement as to the best pacing.

Grade 5

Before beginning testing, make sure that desks are clear, and that each student has a pencil. Ask the teacher to write his/her last name on the board. Try to seat the students some distance apart.

> GOOD MORNING. TODAY WE WOULD LIKE YOU TO DO SOME READING EXERCISES. WE WANT TO FIND OUT WHAT THINGS ARE EASY AND WHAT THINGS ARE HARD FOR STUDENTS YOUR AGE TO DO. YOU CAN HELP US BY DOING YOUR BEST WORK ON THESE READING EXERCISES.
>
> NOW I WILL PASS OUT THE WORK BOOKLETS. ON THE COVER PAGE FILL IN YOUR NAME, FIRST NAME AND LAST NAME, YOUR SCHOOL, AND YOUR TEACHER'S NAME. THE TEACHER'S NAME IS WRITTEN ON THE BOARD. DO NOT OPEN THE BOOKLET.

Pass out the booklets. Make sure all students fill in the information on the cover sheet.

> WHEN YOU HAVE FINISHED, LOOK UP AT ME, SO I'LL KNOW YOU ARE READY TO BEGIN.

When all are ready, begin the test.

Pages 1 & 2

> OPEN YOUR BOOKLETS TO PAGE 1......THE INSTRUCTIONS SAY:
>
> "IN THE FOLLOWING SENTENCES OR PARAGRAPHS, SOMETHING HAS BEEN LEFT OUT. BELOW EACH BLANK ARE SOME CHOICES OF WORDS TO FILL THE BLANK. MORE THAN ONE WORD MIGHT MAKE SENSE IN THE BLANK. Circle ANY WORD WHICH WOULD MAKE SENSE IN THE BLANK."
>
> LOOK AT THE EXAMPLE: MARY WORKED HARD ON HER ENGLISH __________. CIRCLE THE WORDS YOU THINK COULD BE USED TO FILL THE BLANK.
>
> . . . .
>
> YOU COULD USE STORY. MARY WORKED HARD ON HER ENGLISH STORY.
> YOU COULD USE PAPER. MARY WORKED HARD ON HER ENGLISH PAPER.
> YOU SHOULD HAVE CIRCLED BOTH WORDS -- STORY AND PAPER.
>
> ARE THERE ANY QUESTIONS?
>
> DO PAGES 1 AND 2, THEN STOP.

Pause as students turn the page, then begin the instructions. Pause again to give students time to respond to the example. As students work, circulate around the room. Make sure the students are circling, not writing the word in the blank. Make sure students do both pages.

If students ask about the numbers, say that "THE NUMBERS ARE USED TO CODE RESPONSES FOR COMPUTER SCORING."

For the example, if a student asks about choice b, composed, say "NO. YOU COULD SAY SHE WORKED ON HER ENGLISH COMPOSITION. COMPOSED IS THE WRONG FORM OF THE WORD, SO IT WON'T FIT. If a student asks about choice d, experiment, say "NO. THAT'S NOT A VERY GOOD CHOICE. YOU MIGHT TALK ABOUT A SCIENCE EXPERIMENT, BUT PROBABLY NOT AN ENGLISH EXPERIMENT."

As most students are finishing, say:

PLEASE FINISH UP PAGE TWO.

Pause 15 seconds, then go on. All students except occassional, very slow readers, should have finished.

Page 3

TURN TO PAGE 3..... THE INSTRUCTIONS SAY:

"IN THE FOLLOWING SENTENCES OR PARAGRAPHS THERE IS ONE WORD WHICH IS THE BEST CHOICE TO FILL THE BLANK. Circle ONE WORD FOR EACH BLANK."

LOOK AT THE EXAMPLE: JOHN WENT TO THE __blank__ TO __blank__. THE CHOICES FOR BLANK A ARE IN THE COLUMN LABELED A. THE CHOICES FOR BLANK B ARE IN THE COLUMN LABELED B. CIRCLE THE ONE WORD WHICH YOU THINK IS THE BEST WORD TO FILL EACH BLANK.

. . . .

THE BEST CHOICES ARE POOL AND SWIM.

JOHN WENT TO THE POOL TO SWIM.

YOU SHOULD HAVE CIRCLED THE WORD POOL AND THE WORD SWIM.

ARE THERE ANY QUESTIONS?

DO THE THREE ITEMS ON THIS PAGE, THEN STOP.

As students work, circulate around the room. Make sure they are circling only one word for each blank.

If students suggest other combinations on the example, say that "OTHER THINGS MIGHT BE POSSIBLE, BUT THE MOST LIKELY COMBINATION IS TO GO TO THE POOL TO SWIM."

When all students have finished, go on.

TURN TO PAGE 4..... THE INSTRUCTIONS SAY:

"IN THESE SENTENCES OR PARAGRAPHS THERE IS STILL ONE WORD WHICH IS THE BEST CHOICE TO FILL THE BLANK. BUT THIS TIME THINK ABOUT WHAT WORDS IN THE SENTENCE OR PARAGRAPH HELPED YOU DECIDE WHAT TO CHOOSE FOR THE BLANK. Circle THE WORD WHICH FITS BEST IN THE BLANK, THEN circle ANY WORDS WHICH HELPED YOU DECIDE WHAT TO USE FOR THE BLANK."

Pages 4 & 5

LOOK AT THE EXAMPLE: THE UNHAPPY LITTLE GIRL blank AS LOUD AS SHE COULD. CIRCLE THE BEST WORD TO FILL THE BLANK. THEN CIRCLE ANY WORDS IN THE SENTENCE THAT HELPED YOU DECIDE.

. . . .

THE BEST WORD TO FILL THE BLANK IS CRIED.
THE UNHAPPY LITTLE GIRL CRIED AS LOUD AS SHE COULD. YOU SHOULD HAVE CIRCLED THE WORD CRIED.

ONE CLUE WORD IN THE SENTENCE IS THE WORD UNHAPPY. THE WORD UNHAPPY HELPED YOU CHOOSE THE WORD CRIED TO FILL THE BLANK. YOU SHOULD HAVE CIRCLED THE WORD UNHAPPY.
SOMETIMES YOU MAY THINK THAT THERE IS MORE THAN ONE CLUE WORD IN THE SENTENCE OR PARAGRAPH. CIRCLE ANY WORDS THAT HELP YOU DECIDE ON THE BEST WORD TO FILL THE BLANK.

ARE THERE ANY QUESTIONS?

DO PAGES 4 AND 5, THEN STOP.

If students suggest other clue words in the example, accept them as also correct, as long as they chose cried and circled unhappy.

As students work, circulate to make sure they are marking correctly. Make sure they do both pages. As most students turn to page 5, say:

BE SURE TO CIRCLE ANY WORDS THAT HELPED YOU DECIDE WHAT WAS BEST FOR THE BLANK.

As most students are finishing, say:

PLEASE FINISH UP PAGE 5.

Pause 15 seconds, then go on. Most students should have finished.

Page 6

TURN TO PAGE 6..... THE INSTRUCTIONS SAY:

"IN THESE LAST SENTENCES OR PARAGRAPHS, MAKE UP YOUR OWN WORD WHICH MAKES SENSE IN THE BLANK. THEN circle ANY WORDS THAT HELPED YOU DECIDE WHAT TO USE FOR THE BLANK."

LOOK AT THE EXAMPLE: THE DOG blank AT THE BOY. YOU WRITE A WORD IN THE BLANK. THEN CIRCLE ANY WORDS THAT HELPED YOU DECIDE WHAT TO WRITE.

. . . .

ONE WORD THAT YOU COULD WRITE IS BARKED. THE DOG BARKED AT THE BOY. YOU MIGHT HAVE CHOSEN ANOTHER WORD. WHATEVER YOU CHOSE IS ALL RIGHT AS LONG AS IT MAKES SENSE IN THE BLANK.

ANY WORD YOU USE WOULD HAVE TO BE SOMETHING A DOG WOULD DO. THE WORD DOG DETERMINES WHAT YOU USE FOR THE BLANK. YOU SHOULD HAVE CIRCLED THE WORD DOG.

ARE THERE ANY QUESTIONS?

DO THIS ONE PAGE, THEN STOP.

As students work, make sure they are marking correctly. As most students are finishing, say:

PLEASE FINISH UP PAGE 6.

Pause 15 seconds, then go on. Most students should have finished.

Page 7

TURN TO PAGE 7..... THE INSTRUCTIONS SAY:

"READ EACH SENTENCE BELOW AND NOTE THE UNDERLINED WORD. THEN READ THE WORDS OR PHRASES BELOW THE SENTENCE AND circle THE ONE THAT MEANS THE SAME AS THE UNDERLINED WORD."

I THINK YOU KNOW HOW TO DO THIS WITHOUT AN EXAMPLE. ARE THERE ANY QUESTIONS? DO THIS ONE PAGE, THEN STOP.

As students work, circulate to make sure they mark correctly. When all students have finished, go on.

Pages 8 & 9 & 10

TURN TO PAGE 8..... THE INSTRUCTIONS SAY:

"READ THE SENTENCE IN THE BOX. THEN READ THE SENTENCES BELOW THE BOX. IF A SENTENCE MEANS THE SAME THING AS THE SENTENCE IN THE BOX, circle "SAME". IF ANY PART OF THE SENTENCE MEANS SOMETHING DIFFERENT FROM THE SENTENCE IN THE BOX, circle "DIFFERENT."

LOOK AT THE EXAMPLE. THE SENTENCE IN THE BOX SAYS:

"JOHN RAN QUICKLY UP THE STREET."

YOU READ THE SENTENCES BELOW THE BOX. CIRCLE "SAME" OR "DIFFERENT."

. . . .

YOU SHOULD HAVE CIRCLED SAME FOR SENTENCE A, SAME FOR SENTENCE B, AND DIFFERENT FOR SENTENCE C.

ARE THERE ANY QUESTIONS?

DO PAGES 8 AND 9 AND 10, THEN STOP.

If students ask questions about the example, point out that in A the order of the words has been changed, but the sentences mean the same thing. In B, the words raced and ran mean about the same thing. In C, the words slowly and quickly are different in meaning. Make sure students continue to pages 9 and 10, then stop.

As the students work, circulate to make sure they are marking correctly.

On this section, some students will finish much earlier than others. Ask those who finish early to wait for the others. Try to give most students enough time to finish, if possible. If the class gets restless, go on.

PLEASE FINISH UP PAGE 10.

After 15 seconds, go on.

Page 11

TURN TO PAGE 11..... THE INSTRUCTIONS SAY:

"REWRITE THE SENTENCE. KEEP THE SAME MEANING. CHANGE OR REARRANGE ANYTHING THAT'S IN THE BOX."

LOOK AT THE SENTENCE BELOW: "IN A FLASH THE FIGHT WOULD BE ALL OVER."

REWRITE THAT SENTENCE SO THAT IT SAYS THE SAME THING BUT IN A DIFFERENT WAY. CHANGE OR REARRANGE ANYTHING IN THE BOX.

WRITE YOUR SENTENCE BY NUMBER 36.

THEN REWRITE THE SENTENCE ANOTHER WAY, BY NUMBER 37.
IN THE MIDDLE OF THE PAGE IS A SECOND SENTENCE.
REWRITE THAT SENTENCE, TOO.

ARE THERE ANY QUESTIONS?

DO BOTH SENTENCES, THEN STOP.

Do not give more explanation than what is covered here or in the test booklet. Repeat the instructions if necessary. Encourage the students that anything they figure out is all right. Don't spend too long on this page.

When most students are on the second sentence, say:

PLEASE FINISH UP THIS PAGE.

After 15 seconds, go on.

Page 12

TURN TO PAGE 12..... THIS PAGE GIVES INSTRUCTIONS FOR THE LAST TYPE OF EXERCISE YOU HAVE TO DO. THE INSTRUCTIONS SAY:

"READ THE STORY CAREFULLY. AFTER THE STORY ARE TWO KINDS OF QUESTIONS."

I'LL READ THE SAMPLE STORY OUT LOUD WHILE YOU READ IT TO YOURSELF.

"THE BULLDOG FANS WERE WORRIED. THE SCORE WAS TIED IN THE LAST MINUTE OF AN IMPORTANT BASKETBALL GAME. SUDDENLY ONE PLAYER SAW AN OPENING. HE DUCKED THROUGH AND TOOK A SHOT AT THE BASKET. THE BALL BOUNCED ON THE RIM THEN DROPPED THROUGH THE BASKET. CHEERS AROSE FROM ONE SIDE OF THE GYM, AND GROANS AROSE FROM THE OTHER. THE BULLDOGS HAD WON THE GAME."

"THE FIRST QUESTION ASKS YOU TO DECIDE WHAT THE STORY IS MAINLY ABOUT. THERE ARE 4 CHOICES. CIRCLE THE NUMBER OF THE PHRASE THAT TELLS BEST WHAT THE STORY IS MAINLY ABOUT."

YOU CIRCLE THE NUMBER OF THE PHRASE THAT TELLS WHAT THE SAMPLE STORY IS MAINLY ABOUT.

. . . .

YOU SHOULD HAVE CIRCLED NUMBER 2. THE STORY IS ABOUT HOW THE BULLDOGS WON THE GAME.

"AFTER THE QUESTION ARE SOME SENTENCES. IF THE SENTENCE MEANS THE SAME THING AS PART OF THE STORY, CIRCLE THE WORD 'SAME.' IF ANY PART OF THE SENTENCE MEANS SOMETHING DIFFERENT FROM THE INFORMATION GIVEN IN THE STORY, CIRCLE THE WORD 'DIFFERENT.'"

YOU READ THESE 3 SENTENCES AND CIRCLE SAME OR DIFFERENT.

. . . .

FOR SENTENCE B, YOU SHOULD HAVE CIRCLED SAME. WE KNOW THAT IT IS THE LAST MINUTE OF THE GAME AND THAT A PLAYER TOOK A SHOT AT THE BASKET.

FOR SENTENCE C, YOU SHOULD HAVE CIRCLED SAME. WE KNOW THAT THE BALL WENT THROUGH THE BASKET, AND IT MUST HAVE BEEN THE BULLDOGS WHO SCORED, BECAUSE THEY WON.

FOR SENTENCE D, YOU SHOULD HAVE CIRCLED DIFFERENT. SOME PEOPLE CHEERED BUT OTHER PEOPLE GROANED.

ARE THERE ANY QUESTIONS?

THERE ARE 4 STORIES WITH QUESTIONS LIKE THESE. DO ALL 4 STORIES. IF YOU FINISH EARLY THERE IS AN EXTRA EXERCISE AT THE END THAT YOU CAN DO IF YOU WANT.

As the students work, circulate to make sure they read the story then mark their answers correctly. Give everyone a chance to finish if possible. Let those who finish early do other seat work, if they want. Encourage students to keep working. As most have finished, say:

WHEN YOU HAVE FINISHED, CLOSE THE BOOKLET AND I WILL COLLECT IT.

Collect the booklets as students finish. Be sure that full name, teacher's name, and school are recorded.

THAT'S ALL FOR TODAY. THANK YOU!

Changes for POSTTEST:

Change the opening speech to:

GOOD MORNING. YOU PROBABLY REMEMBER A COUPLE WEEKS AGO YOU DID SOME READING EXERCISES. WE WOULD LIKE YOU TO HELP US AGAIN, BY DOING SOME OF THE EXERCISES OVER AGAIN. SOME OF THEM MAY SEEM EASIER THIS TIME AND SOME MAY NOT. DON'T WORRY ABOUT WHAT YOU DID BEFORE. JUST THINK ABOUT THE BEST ANSWER FOR EACH QUESTION. IT IS IMPORTANT THAT YOU WORK CAREFULLY.

NOW I WILL PASS OUT THE WORK BOOKLETS. ON THE COVER PAGE, PRINT YOUR NAME, FIRST NAME AND LAST NAME, YOUR SCHOOL, AND YOUR TEACHER'S NAME.

Make no secret of the fact that the test is the same. But encourage the students to do their best work this second time. Ask them to help us out, and stress that it is important that they work carefully, even though they've done it before.

The test itself is given basically the same way. Since the students are familiar with the format, it should be possible to go through the examples more quickly. If the students seem to understand, leave out any discussion of the correct answer. But make sure students mark the example properly. For example, on page 1 you could say:

LOOK AT THE EXAMPLE: MARY WORKED HARD ON HER ENGLISH ________.
CIRCLE THE WORDS YOU THINK COULD BE USED TO FILL THE BLANK.

. . . .

YOU SHOULD HAVE CIRCLED TWO WORDS -- STORY AND PAPER.

ARE THERE ANY QUESTIONS?

Resist the temptation to skip the examples entirely. There are subtle changes in the instructions, and it is important that the students know exactly what to do. Try to keep moving through the test, so that some students don't get ahead of the rest, particularly in the first 4 sections.

APPENDIX I

THE FIFTH GRADE
ETU IN READING

EXPERIMENTAL TEACHING UNIT
FIFTH GRADE

READING

Developed by

Teacher Education Division
Far West Laboratory for
Educational Research and Development
1855 Folsom Street
San Francisco, CA 94103

Introduction to the Unit

This Experimental Teaching Unit is intended to give students some practice in important reading skills. There are three sections to the unit, each of which deals with slightly different skills.

For each section the following things are included in this packet:

(1) a brief overview of the skill area
(2) a list of performance objectives for the students
(3) a set of sample instructional materials (you may use those included, select some from another source, or create your own)
(4) some suggestions on ways to use the materials and on other related activities.

Your students will be both pre-tested and post-tested on the objectives listed in each section. Individual student scores on the pre-test will be provided for you.

Please spend about 40 minutes a day on work related to these objectives. This means that any one student who is working on unit activities should spend no more than about 40 minutes total during the day.

There are many different ways of organizing the materials and of relating one objective to another. Many exercises can be planned to cover more than one objective. If you wish, objectives from different areas can be included in the same lesson. We are interested in the variety of ways to teach these reading skills. You may teach as much of the unit to as many of your students as you wish, and in any manner you choose.

As much as possible, please keep track of what materials and activities you use to teach the unit. To help you do this, please follow these procedures:

(1) Each of the three sections in the ETU is composed of a set of instructional objectives.
    (a) For each section, select the objectives you plan to use.
    (b) Arrange the objectives in the order in which you plan to use them and place the appropriate number in the space provided. (You will use this number to identify each objective on your teaching record, so do this before you begin the unit.)
(2) Use the Daily Teaching Record, to keep track of the instructional objectives and the materials or activities you focus on each day.

At the end of the unit we would like to get information from you on questions like:

(1) What materials did you use (either from the packet or of your own devising)?
(2) In what order were objectives and materials used?
(3) Which materials/activities worked well and which less well?
(4) What was the reaction of the children to the unit?
(5) What procedures did you use to teach different objectives?

We hope you, as teachers, will feel free to try out different approaches to teaching this unit.

Overview of Skill Areas

This unit is designed to improve a student's reading comprehension by increasing his understanding of the way language works. The purpose of written language is to communicate a message. The most important task of the reader is to figure out the underlying meaning of what is written. To do this, he must go beyond the decoding of individual words and deal with larger units. At this stage, a competent reader does not remember every word exactly as it is written. He may not even read every word. What he does get is the "gist," the underlying meaning, of what he reads.

To improve reading for meaning, the student is introduced to the concept of paraphrase. A particular idea can be stated in a number of different ways. The external form of the message can change as sentences are rewritten, but the underlying meaning stays the same. This concept of paraphrase is applied at three levels: (1) different words can be used to represent the same concept (synonyms); (2) sentences can be rewritten to express the same idea; and (3) paragraphs or stories have a major topic and can contain ideas written in different ways.

Another section of the unit gives the student practice in using context clues. As a skilled reader processes a sentence, he uses his knowledge of language to make predictions about what words will appear. By integrating words into the larger unit of the sentence or paragraph, the reader can decode words with a minimum of visual cues. He relies on the redundancy of language to fill in additional features.

Record Keeping

It is important to the study for us to find out how different people go about teaching this unit. We would like you to help by keeping records as you teach the unit. Record keeping is often time consuming, but we hope these procedures will be convenient and not add too much to the normal demands of preparation. Please do the following:

1. You have numbered the instructional objectives in the order in which you introduce them. Place the numbers on the lines to the left of the objectives. (Note: The fact that you number objectives consecutively does not mean that you have to complete work on one objective before moving to another.)

2. For each teaching day, record information about time and students taught. Use the form labeled "Time Record."

3. For each teaching day write a brief description of the day's activity. Use the "Daily Teaching Record" form. Please be sure you included the following things in your description:

   a. Objective covered;
   b. Materials used;
   c. Activities or ways of using materials.

   If you use materials or activities from the packet you can refer to them by the identification number. (Materials are identified by page, in the upper right hand corner. Activities are identified by the number to the left of the paragraph description.)

   You may fill out the "Daily Teaching Record" either before or after the actual lesson. If you fill it out before, please note any changes you made during the actual teaching, also record the general pupil reaction to the lesson. Use the spaces labeled:

   Changes while teaching
   Pupil response

   You can also use the section labeled "Additional Comments" to make comments about the lesson. If possible, please save a copy of any work sheets you make up.

NAME ______________________ I-5

DATES ______________________

TIME RECORD

	START	STOP	STUDENTS WORKED WITH*
DAY # 1			
DAY # 2			
DAY # 3			
DAY # 4			
DAY # 5			

	START	STOP	STUDENTS WORKED WITH*
DAY # 6			
DAY # 7			
DAY # 8			
DAY # 9			
DAY # 10			

* If you work with the entire class, write "entire class". If you work with a subset of the class, write the student's names.

I-7 NAME ____________________

DAILY TEACHING RECORD

DAY ____________________

Objectives:

Materials/Activities:

Changes While Teaching:

Pupil Response:

Additional Comments:

Context Clues

This entire section deals with the child's ability to recognize and use context clues in sentences or in paragraphs. The child will use context clues to predict missing parts of the sentence or paragraph. These exercises draw on the child's knowledge of language patterns and focus attention on the coherence and predictability of language. The number of words which can fit in any blank is limited by the surrounding context.

The context clues may be of different types -- sometimes a single word, sometimes a phrase or two, and sometimes the general "sense" of the paragraph. The child should be able to use these context clues to fill blanks from a set of alternatives or by generating his own words. Finally, the child should be able to identify the specific parts of the sentence or paragraph, the context clues, which helped him fill a blank.

Objectives:

Given a blank in a sentence or paragraph:

____ the child can choose a correct word to fill the blank (only one alternative correct), based on context clues.

____ the child can indicate the parts of the context which helped him make his choice.

____ the child can choose the acceptable alternatives to fill a blank (more than one alternative acceptable), based on context clues.

____ the child can generate an acceptable word to fill a blank, based on context clues.

Given several blanks in a sentence or paragraph:

____ the child can generate acceptable words to fill the blanks, based on context clues.

____ the child can indicate the parts of the context which helped him make his choice (including other blanks).

____ the child can choose acceptable words to fill the blanks (more than one alternative acceptable per blank), based on context clues.

____ the child can choose the correct words to fill the blanks (only one alternative acceptable per blank), based on context clues.

Working with Words in a Sentence:

1. Give children several sentences with one or two single-word blanks. Provide choices of words to fill each blank. Ask the children to select the word or words which are appropriate to fill the blank. Sometimes one of the choices may be clearly the best word to fill the blank. (See materials pages 103 and 104.) Other times more than one of the choices might be acceptable. (See pages 101 and 102.) Discuss with the students how they chose a word to fill the blank. Have them read the sentences aloud trying out both correct and incorrect choices.

2. Give children several sentences with one or two single-word blanks. Ask them to think up an appropriate word to fill each blank. (See pages 105 - 107.) Later, discuss the variety of choices and the clue words that led to their choices.

3. Work through with the class some sentences which have definite clue words. (See page 105.) Ask the children what would happen if a major clue word were changed. What if the word "bat" in sentence 2 were changed to "ball" or "net" or "raquet"? What if "car" in sentence 3 were changed to "man" or "robber" or "horse" or "cat"? These sentences, which were written by fifth graders, provide good sentence frames for exploring the interrelationships of words in a sentence.

4. Have children write their own sentences leaving a single-word blank. The object is to write the sentence so the answer is obvious. Writer of sentence gets 5 points if children are able to fill in the blank the first time. Discuss clue words drawn upon to be able to fill in the blank appropriately.

5. Using sentences with a blank and the first letter of the missing word ask children to list words that might fit in the blank. Allow them to discover that they needed to look at the first letter as well as the context clues.

   Example: Mark enjoys feeding the c_______.

   Why would dog be incorrect?

   Continue by inserting the last letter: c___w.
   Which word could now be correct? Would cattle be correct? Why?

6. Give children sentences with one blank where it is obvious that a particular form of word is required.

   Example: The ________ walked slowly.

   A noun response is required in this example.

   When I _________ by, I laughed at the dog.
   pass
   passes
   passed

   In this example, a particular form of verb is required. Discuss why a particular form of word is required. Try others to discover if they will work as well.

7. Discuss such words as "wind." Put wind on the board. Ask children to read the word. What happened? Use it in a sentence. What is the clue word to let us know if it is wind or wind?

   Partial list of homographs: close, lead, object, present, read, row, record, separate, tear, wound, live, bow, content, dove, excuse, house, sow, use

8. Ask children to look at analogies. (See page 109 of materials.) Working together decide the appropriate word for the blank. Discuss the relationship that led the children to make the correct response.

9. Write on the board:

   The ___________ doctor ___________.

   Ask children each to add one word to the sentence that would make sense. Leaving this expanded sentence on the board, erase doctor and find out if any other word would still make sense in their sentence. Why? Why not? Try erasing other words and making substitutions. If you change one word, does that make other changes necessary? What clue words did you draw on for your substitutions?

10. Context clues can be used by the reader to help define new words. Have the student read a sentence containing a difficult or unknown word. What must the word mean so that the sentence makes sense? (See materials pages 115 and 116.)

11. Sentences with nonsense words can be used to practice context clues. What is the meaning of the underlined word in this sentence:

    Seven yellow fleegles grew in the garden.

Working with Words in a Paragraph:

15. Give each child a copy of a paragraph with blanks. Ask them to fill in the blanks to make their story the most interesting. Later, meet with this same group of children and share responses and reasons for making such responses. Draw on the idea that several different responses do indeed make sense while making our language fun and interesting. Discuss how some blanks have several possibilities while some have few. Why? (See materials page 111.) Notice that information from surrounding sentences must often be used to decide on the word. For blanks near the end of a paragraph, the context may lead up to that blank. For other blanks, the context after the blank may need to be considered to select the best word.

16. Give each child a paragraph with blanks. These blanks should have one possible answer. Let children discover when they meet again that everyone has the same answer. Discuss why. What were the clue words? (See materials page 113.)

17. Ask children to write their own paragraphs leaving some words blank. Meet with same group, choose partners and exchange papers. Partner will then fill in blanks. Meet again and discuss why some blanks had several possibilities while some had only one. Did you change the meaning of the author's intentions?

18. Read a story with repeated language patterns. Are there some cases where you "expect" a specific word to appear? Try "Sody Sallyraytus" from Sounds of a Young Hunter by Bill Martin, Jr.

19. Most of these exercises have to do with predicting content words -- nouns, verbs, or adjectives. An even more predictable part of language is the function words. Take a passage, delete the function words, and let the students fill them in. How many choices did they find for different blanks?

20. Sometimes a student can read and understand a passage even when words have been deleted. The skilled reader gets the general meaning without needing each word. Or he fills in the words from context automatically, without thinking about it. Using materials pages 118, ask the students to read through the whole story quickly and figure out what is going on. Go back and fill in the blanks only if the student needs help.

21. Give the students a copy of a paragraph with some words changed so they do not fit in the context. (See materials page 117.) Have the students read the passage to answer the main idea questions. Then ask them if they noticed anything wrong with the passage. Sometimes good readers will not notice mistakes because they automatically correct them to fit the context. (This is a good sign, and shows how the process of reading works.) Sometimes mistakes are obvious because the word just doesn't fit the context. Can the students find and correct 6 mistakes on page 117?

22. Read a variety of paragraphs which are descriptive, expository, or active in nature. Lead children to discover the types of words they would expect to find in each of the paragraphs. Build on the language patterns found in each paragraph. What kinds of words are used to evoke a particular feeling?

Games:

25. Child thinks of a person or thing. He gives one-word clues to the other children about his word. Object is to guess the word in as few clues as possible. After the word has been guessed, write on the board what the children feel to be the most important clues.

26. Open-Ended Game Board

    Child draws a card containing a sentence with a single-word blank and choices of words to fill the blank. He must choose the correct word before he may move. Answer key should be available so answers may be checked.

27. Tic-Tac-Toe

    Child draws a card containing a sentence with a single-word blank. He must give the correct answer before placing his "X" or "O".

28. Form two teams. The first player on each team walks to the board and writes a word for his team. Each member of the team, in turn, adds a word to the sentence that the first player started. The added word must be the next word in the sentence and it must make sense. The first team to complete an intelligible sentence in which each player has added a word is the winner. If each team has 8 to 10 players, the children will have to think up fairly complex sentences.

29. Choose any story for children. One child reads the story stopping frequently at some point where the next word seems obvious. Other children attempt to fill in the word. If several give the correct word together, all gain a point. Child to score highest number of correct words is the winner and the next reader.

1. Sometimes a toy ______________ hums when you spin it.

yo-yo   dog   top   dryer

2. When the painter finished his work, he stopped to admire his ______________.

song   creation   book   painting

3. Father dug a big ______________ in the backyard.

hole   tree   pit   water

4. Throughout the years, scientists have discovered certain ______________ facts about air.

silly   strange   important   unknown

5. Our short-cut took us ______________ the thickest part of the woods.

into   through   around   under

6. I'll ______________ your garden for you.

lightly   water   weed   jump

7. Danny cannot understand how money disappears so ______________.

slow   easily   quickly   quietly

8. He went to the ______________ for a swim.

swimming   lake   sunny   pool

1. People who ____1____ pets should ____2____them carefully.

take	train
own	watch
exchange	treat

2. When Ed was given ___1___ for the day's work, he felt he had been __2__.

(1)	(2)
only a quarter	cheated
fifty dollars	underpaid
only a dime	overpaid

3. The ___1___ in my ___2___ broke.

(1)	(2)
ink	pencil
lead	pen
chalk	hand

4. There were ___1____ at the city ___2____.

green	zoo
elephants	park
ducks	wild

1. The ______________ repairman doesn't know to whom this TV set belongs.

confident happy confused

2. Mr. Evans needed the ______________ of each citizen in his clean-up drive.

suppose support suspense

3. When the town grew larger, the number of stores ______________.

stayed the same decreased increased

4. The plane is capable of speeds greater than the ______________ of sound.

speed speak speech

5. Julie accidentally stuck her finger with a ______________.

jar needle thread

6. Good food, exercise, and rest are ______________ for good health.

necessary unimportant interesting

7. If you break any of the rules, you will be ______________.

rewarded punished excused

8. ___________________ had been placed around the playing field to hold back the crowd.

seats trees ropes

1. The ____(1)____ tried to separate the ____(2)____ from her colt, but couldn't keep them apart.

(1)	(2)
teacher	pupil
cowboy	cow
father	horse

2. John had no love for ____(1)____; he especially disliked ____(2)____.

(1)	(2)
auto repair	drying dishes
housework	clean
dirty	wearing shoes

3. The ____(1)____ worked hard to remove all traces of ____(2)____ from the city.

(1)	(2)
lawyer	disease
doctor	garbage
teacher	safety

4. Daniel Boone realized that the Indians were becoming ____(1)____ and trouble was ____(2)____.

(1)	(2)
hostile	impossible
friendly	likely
tired	winning

1. Susan looked at the moon and ____________________ in the sky.

2. I like to play ____________________ because you get to use a bat.

3. The car ____________________ away.

4. You can tell what time it is if you look at the ____________________.

5. I am going to go ____________________ and catch some fish for my mother.

6. Mother went to the ____________________ to buy groceries.

7. The sky is ____________________ and cloudy.

8. We ran out of ____________________. It's a good thing there was a

gas ____________________ near by.

9. My ____________________ barks when ____________________ try to break

into our house.

1. I'll ________________, if you will lead the way.

2. Go to the ________________ to check out the books you need.

3. The white duck led her six baby ________________ to the pond for their first ________________.

4. The sleepy child soon went to ________________.

5. The noise ________________ out the sound of his voice.

6. One spring, the ________________ overflowed its banks.

7. Harry fell into the ________________ and his clothes got ______________.

8. The ten-year old girl had a ________________ cake with ten ______________ on it.

9. The bites of food were too ________________ for the baby to chew.

10. She wore a blue belt around her ________________.

1. I sit at my _________________ in school.

2. I was very _________________ at my mother.

3. The quarterback threw a long _________________ to the receiver.

4. I was ___________________ because the robber had a gun.

5. There is a _________________ of the United States in our room.

6. Matt has a _________________ temper.

7. At the pool, I like to jump off the high _________________.

8. The man looked _________________ but he was a crook.

9. Larry was cold because he had lost his _________________.

1. It is c______________ outside today.

2. Ask the team members to m______________ here after school.

3. The two big roosters had a f______________.

4. The king will r______________ over the entire kingdom.

5. The b______________ on our car need tightening so we can stop on a dime.

6. A dog suspected of having r______________ is observed for 10 days.

7. I eat lots of bread and j______________.

8. The ball r______________ down the hill.

1. Sky is to airplane as ________________ is to boat.

2. Colt is to horse as ________________ is to cat.

3. Hand is to glove as ________________ is to shoe.

4. Finger is to ____________ as ____________ is to foot.

5. Horse is to stable as dog is to ________________.

6. Umbrella is to rain as jacket is to ________________.

7. Paw is to dog as claw is to ________________.

8. ________________ is to sailor as spaceship is to astronaut.

9. Wind is to sail boat as ________________ is to car.

10. Bullet is to rifle as ________________ is to launching pad.

11. Car is to road as ________________ is to track.

12. Moon is to earth as earth is to ________________.

13. Piano is to music as pencil is to ________________.

1. I went to the ______________ and saw lots of animals. One of them was a lively little monkey. He swung around with the other ______________. Then we went and saw the birds. They were __________________ all over the place. We even had to duck our __________________.

2. Whenever we hear the word "pirate," we can just imagine what he looks like. He is a big, __________________ man. A jagged red scar crosses his __________________ and disappears into his long, bushy beard. A broad-brimmed hat shields one steel-blue eye from the blistering hot sun. A black __________________ covers the other __________________. He has either a peg for a leg, or a hook in place of a hand. In his wide belt is a large pistol, a __________________ sword, and a knife. Other men __________________ him and do what he wishes.

1. Saturday we went to Santa Cruz. There we cooked our dinner. My parents slept in the camper and so did my littlest brother. My other ______________ and I slept in a pup ______________. It looked small from the outside, but when I got in it seemed very ______________. We brought 2 of our dogs because Sunday there was a dog ______________. After the dog show we went swimming. Then we came ______________.

2. Once I was walking down the ______________ and saw an apple tree with big red ______________. I took one. It was very ______________. As I was eating my ______________ someone came out and ______________ a rock at me and __________ "Get out of my ______________." So I told him I was __________ and walked over to my best ______________ house and ate ______________ over there and ______________ the night. It was very much ______________.

1. In a few ________________, the sound of the river increased to a deep roar. Rapids were ahead. The men in the boats began to ________________. The river swept around a bend. The water dashed and swirled about a hugh boulder. The men grabbed the ________________ of their ________________ and hung on as their boats were flung like matchsticks through the ________________ water. Soon the boats were full of ________________, but the watertight compartments kept them afloat and their ________________ dry.

2. The prisoner started to run like the ________________. The Indian was right on his heals. Suddenly, ________________ out by the chase, the prisoner stopped and ________________ around. The Indian was so ________________ that his own weary legs failed him. He stumbled and ________________. The prisoner was on him in a ________________. The knife intended for the ________________ went into the warrior instead.

1. Tom's eye lighted upon the log table in front of the fireplace. He had never dreamed that one table could hold so many good things to ____________. At one end, there was a blue bowl piled high with a mountain of snowy, white ____________. At the other end of the ____________ two fat, brown ____________ pointed their drumsticks into the air. There were loaves of ____________ still warm from the ____________, dishes of cheese, bowls of applesauce and good yellow turnips. Best of all were the golden-brown apple ____________.

2. John slid into a bleacher seat and looked down at the baseball ____________. The grass had never looked so ____________ on TV. Then he looked across at the other bleachers. Blue and white pennants fluttered in the air. Boy Scouts in green uniforms ____________ together in a bunch. Ladies in red and yellow and blue sunhats bobbed their heads as they talked and watched. And up and ____________ the rows marched men in white aprons. They had ____________ dogs and ____________ drinks to ____________.

1. Sometimes you can see water bubbling out of a rock. The water comes from a spring under the rock. Most spring water is cool, but when it comes from deep inside the earth, spring water may be hot. These springs are called hot springs. If tiny bits of minerals from underground rocks mix in the water, these springs are called mineral springs.

2. The little colt was frightened, for straight at him came the great gray wolf. The colt was trapped against a rocky wall. He wheeled around, but there was no escape. The wolf came closer. In a flash it would be all over. Intent upon his tender victim, the wolf did not hear the sound of a running horse behind him. The colt's mother was coming to rescue him in the nick of time.

1. The smog made the day so gloomy that we could hardly see the buildings on the other side of the river.

   dark

   quiet

   windy

2. Gene's reflection in the pool was so clear that he could see the freckles on his face and the checks on his shirt.

   image

   shadow

   thoughts

3. Dr. Martin usually gives a very thorough examination. She likes to check everything to be sure that you're in good health.

   fast

   complete

   painful

4. The villagers bought the produce that the farmers had grown.

   animals

   milk

   food

5. The huge crane was able to hoist the heavy packages onto the ship.

   unload

   lift

   remove

1. A ferocious lion can kill animals that are larger and faster that it is.

fierce

tame

weak

2. The speaker talked on and on. He was so loquacious that after his talk there wasn't any time left for the other speeches.

interesting

talkative

boring

3. Rain fell for several days. When it finally stopped, the ground was completely saturated.

soaked

dried

sandy

4. He was a fireman, but among his avocations were collecting stamps and building model ships.

____

5. Ted did the same thing every day, and the monotony of his work bored him.

____

How has San Francisco Changed?

At one time, San Francisco was a small sleepy village in Colorado. Few people lived in the community. Few ships came to its fine house, and fur products came into the village or were taken away from it.

Then gold was found in a place not far away. The "Gold Rush" began. Thousands of people came to San Francisco. They needed food, clothing, tools with which to play, and many other things. The sleepy village became a small but busy city.

A few years later, much of the gold was gone. Many people left San Francisco, but some stayed on. They learned to farm the land, to use trees for lumber, and to make a living in other words. Products were sent to San Francisco to be shipped out. It did not become a ghost town. It grew into a great bay.

On Saturday Robert and I climed down into the canyon. When we were _____ the bottom, Robert started poking ________ in _____ bushes with a stick. "Here it is," he said.

And right there, sticking _________ of the ground, was _______ biggest bone I ________ ever seen. We dug at the bone with sticks, but _______ couldn't budge it. Finally, when I ________ about to collapse, Robert said, "The ground's ________ hard."

"No kidding," I told ________.

We stood ________ for a while; then I got ________ idea. My house was right above us. So I said, "If I drop ____ hose down ________, we can soak _______ ground until ____ _____ soft.

I climbed ____ the canyon wall to get ____ hose. It didn't quite reach ____ bone, but ____ came close ________. Robert climbed partway up the cliff and caught ____ end ____ the hose. I turned on ____ water and let ____ run for more ________ ten minutes. When I got back _________, things were muddy but ____ bone ________ loose. We had it out ____ five minutes.

"Wow! Look ____ it!" I ________ to Robert. "It must be a dinosaur bone! Look how big it is!"

Paraphrase
(Words and Sentences)

The smallest unit of paraphrase is the single word. Particularly for basic concepts, more than one word often exists to express the concept. Such synonyms as "fast," "quick," and "rapid" are an example of paraphrase.

It is at the level of the sentence that the concept of paraphrase is most often applied. Sentences can be rewritten so that the same idea is stated in different ways. These changes can be made by substituting words or by changing the order of the words or by combining both types of changes.

This section of the unit should increase the child's skill at recognizing and producing different statements of the same idea. The child should also recognize that some differences change the meaning of the sentence.

Objectives:

____ Given a sentence with a word underlined, the child can choose a correct synonym from a set of alternatives.

____ Given a sentence with a word underlined, the child can generate an acceptable synonym for the designated word.

____ The child can recognize that two sentences have the same meaning

when different words are used (synonyms)

when the order of the words is changed

when different words are used and the order is changed

____ The child can recognize that two sentences have a different meaning

when different words are used

when the order of the words is changed

when different words are used and the order is changed

____ The child can identify the parts of the sentences that helped him make his decision.

____ Given a sentence, the child can write another sentence with the same meaning by:

substituting synonyms

changing the word order

substituting synonyms and changing the word order

Words:

30. Write some sentences on the board, and underline a critical word in each sentence. Ask pupils to think of a synonym for each underlined word. You could also list possible choices of words below each sentence and ask the child to choose the most appropriate word as a synonym. (See materials page 150.)

31. List pairs of words on the board, some of which are synonyms, and some of which are antonyms. Have the students choose which pairs are synonyms. Or scramble the word pairs and have children draw lines between synonym word pairs. (See materials page 152.)

32. Most workbooks have exercises which pertain to synonyms. You could refer to these for finding appropriate synonym pairs.

33. Put some common words on the board. Ask the students to write as many synonyms as they can for each word.

34. Look for words used often by writers as synonyms. For instance, in newspaper sports reports, what words are used for "win" or "lose"?

35. Extend the concept of synonyms to words which are used to refer to the same concept within the context of a story. Pronouns are used in this way. Also, general words are used to stand in for more specific words. In a story about Nancy, she might be referred to as "the girl." (See materials page 151.)

36. Ask the children to each read a different paragraph and choose 10 key words. Ask them to write synonyms for each of the 10 words and make a crossword puzzle. Exchange papers with a friend and solve the puzzle.

37. Play "Concentration" using synonyms. Player must match a word card with another card which has a synonym of the first word.

Sentences:

51. Show the children a simple line drawing. Ask them to write a sentence describing what they see in the picture. (This should be a simple description, not an elaborative story.) Write on the blackboard the sentences given by different children. Did they all describe the same thing? Did they all say things the same way? Discuss the different ways of saying the same thing.

52. Put a sentence on the board. Ask the children how the sentence could be changed and still say the same thing. The lesson could focus on substituting words (synonyms) or on changing word order or both. See the Bill Martin textbook series for many good sentences to be rearranged. As sentence order is changed, help the children see that groups of words always stick together (prepositional phrases, nouns with modifiers, etc.). You might prompt for additional changes by asking the children to change particular words or by asking questions like "What if the sentence began with . . .". Often exercises on rearranging sentences produce unusual or humorous "wrong" combinations of words. Recognizing such wrong combinations can be a fun type of language play.

53. Divide the children into teams and give them a sentence with many possible paraphrases. Ask the children to rewrite the sentence as many ways as they can. Let the class judge if all the entries are acceptable. The team that can write the most paraphrases wins the game.

54. Pick out a sentence and ask the children to expand and/or contract the sentence. What things can be left out without changing the meaning? What other things are known from the context of the story that could be added to the sentence? The Bill Martin series gives examples of this activity.

55. Take a set of related sentences, each with paraphrases. (See the racer story, materials pages 230-233.) Print each sentence or paraphrase on a separate strip of paper, then shuffle the deck. Ask the children to sort the deck into sets of sentences which go together. The children can then choose one sentence from each set to make up the story. How many different forms of the story can be compiled? Which version do the children like best?

56. Take a group of sentences to which the children have written paraphrases. Divide the sentences up into 2 sets, each of which contains one half of each sentence-paraphrase pair. Ask the children to match up each sentence with its paraphrase.

57. Take a set of famous sayings and restatements of them in ordinary prose. (See materials page 234.) Ask the children to match them up. The children might enjoy adding to the list.

58. Let a group of children play the "gossip" game. One person thinks up a simple story and tells it to the next person, who then turns around and tells the story to the person on the other side. Children will probably retell the story in their own words. This is a form of paraphrase. Discuss with the children how some information gets lost or changed.

59. Using individual word cards, ask children to arrange them in a sentence which makes sense. Read aloud. Then rearrange words to discover that some arrangements will not make sense.

Example: The boy bounces the ball.

Discuss why "The ball bounces the boy." would not be correct.

60. Put a sentence on the board. Ask the students to rewrite the sentence, keeping the same meaning but stating the idea in different words. (See materials page 240.)

61. Have the children read a key sentence and several possible paraphrases of that sentence. Some sentences should be acceptable paraphrases and others should change the meaning of the key sentence. Have the students write SAME or DIFFERENT to indicate whether or not it is an acceptable paraphrase. (See materials pages 235-237.)

1. Nancy is very generous with her books. She has lent me several of them whenever I asked to borrow them.

comfortable

unselfish

happy

2. The sign had so many arrows that drivers were often confused by it and didn't know which road to take.

relieved

aided

mixed up

3. As he walked to school, Mark had the germ of an idea for the science project.

end

beginning

mistake

4. I regret that I must decline the invitation.

accept

keep

refuse

5. The rock climber was exhausted when he reached the top of the mountain.

weary

bored

excited

This story is about someone named Tom. Underline all the words in the story that are used to mean Tom. (Hint: look for 6)

Tom's eye lighted upon the log table in front of the fireplace. He had never dreamed that one table could hold so many good things to eat. The boy looked longingly at the plates of cookies and the juicy red apples. At the other end of the table, he saw two fat brown chickens. Quickly he sat down at the table and filled his plate.

This story tells about the action of rocks falling. Underline all the words in the story that are used to mean falling.

Suddenly John's head jerked up. It began to sound as though the whole world was tumbling down toward him. Rocks had broken loose and were hurtling down. It was a rockslide! Whole trees from above and huge lumps of rock were plunging downward. It was as though the entire world was falling down, and only he was left. He was along on a huge mountain of rock.

UNDERLINE the pairs of words which are synonyms.

weak - dim

sad - joyful

aid - help

least - fewest

silently - noisily

hated - disliked

saved - spent

clever - wise

All by himself Jack had built a racing car to enter in the race.

____ To enter the race, Jack had put together a racing car all by himself.

____ Without any help, Jack had built a racing car to enter in the race.

____ All by himself Jack had bought a racing car to enter in the race.

Jack tested the brakes on his long, low racing car and oiled the wheels for the hundredth time.

____ Jack oiled the brakes on his long, low racing car and tested the wheels for the hundredth time.

____ Jack tried out the brakes on his long, low racer and oiled the wheels for the hundredth time.

____ Jack repaired the brakes on his small low racing car and oiled the wheels for the hundredth time.

Jack's heart began to pound as he put on his football helmet and pushed his racer to the starting line.

____ As Jack put on his football helmet and pushed his racer to the starting line, his heart began to pound.

____ With a pounding heart, Jack pushed his football helmet and put his racer on the starting line.

____ Jack's heart started pounding as he placed the football helmet on his head and pushed his racer to the starting line.

The crowd cheered as Jack leaped into the racer and started down the hill.

____ The crowd cheered as Jack held on to the racer and headed for the hill.

____ The crowd cheered and started down the hill as Jack leaped into the racer.

____ While the crowd shouted, Jack jumped into his car and began moving down the hill.

Jack could hardly breathe as he whizzed down the steep hill.

____ Whizzing down the steep hill took Jack's breath away.

____ Jack had trouble breathing as he walked up the steep hill.

____ As he whizzed down the steep hill, Jack could hardly breathe.

Just as the yelling reached its loudest, Jack's racer shot over the finish line.

____ As Jack's racer shot across the starting line, the yelling reached its loudest.

____ Just as the screams became the loudest, Jack's racer zoomed across the finish line.

____ As Jack's racer shot over the finish line, the yelling reached its loudest.

A stitch in time saves nine.

A rolling stone gathers no moss.

A bird in the hand is worth two in the bush.

Absence makes the heart grow fonder.

Don't put all your eggs in one basket.

Out of sight, out of mind.

You have to keep moving and growing or you get moldy.

You like people more when you are separated from them.

If you plan too much on just one thing, you may be really disappointed when it doesn't work out.

If you take care of small problems, you avoid big problems later on.

You forget about people when you don't see them often.

To have something you can count on is better than to wait and hope for more.

As he parked the car, he saw something strange.

____ He saw something odd when he parked the car.

____ While parking the car, he noticed something strange.

____ He found something weird as the car was parked.

____ When he saw something, the car was parked.

Men and women who enjoy making people laugh can go to the College of Clowns in Florida.

____ In Florida men and women who enjoy making people laugh can go to the College of Clowns.

____ Men and women who can go to the College of Clowns in Florida enjoy making people laugh.

____ Can men and women who enjoy making people laugh go to the College of Clowns in Florida.

____ Men and women who laugh can enjoy making people go to the College of Clowns in Florida.

Everyone stood staring as the rain doused the flames.

____ Everybody stood looking while the rain put out the fire.

____ Everyone stopped staring as the rain quenched the fire.

____ All the people were frozen looking at the rain stopping the fire.

____ Everyone peered quietly when the rain stopped the flames.

The storm stopped as suddenly as it began.

____ As suddenly as it began, the storm stopped.

____ As quickly as the storm stopped, it began.

____ The storm was finished as soon as it began.

____ No sooner had the storm begun then it was finished.

Have you ever thought about all the things that we do with the wood we get from a forest?

____ What do we do with all the wood we get form a forest?

____ How many uses do we have for the wood we get from a forest?

____ Have you considered all the things that we do with the wood from the forest?

____ When we take wood from a forest, what are all the things we do with it?

When I came out, George was there, leaning on a big box.

____ Leaning on a big box George was there when I came out.

____ George was leaning on a big box when I came out.

____ When I came out, leaning on a big box, George was there.

____ When I left, George stayed, leaning on a big box.

1. Since Wally, a baby walrus, drank almost theree gallons of clams, cream and vitamins everyday, she gained more than a pound a day!

2. Bluebeard was a pirate who lived when America was ruled by a British king.

3. One night an old man took a short cut across a field on his way home.

4. We could see the valley from the windows.

5. A new boy and girl came to our school today.

6. Everything's turning brown because of the lack of rain.

Paraphrase
(Paragraph or Story)

At the level of the prose passage or story, the concept of paraphrase can be applied in two ways. An entire paragraph unit can be paraphrased. Just as a sentence paraphrase keeps the basic underlying meaning intact, a good paraphrase of a passage keeps the important points and the main ideas of the passage intact. Details of surface structure form may be changed, but the essential meaning of the paragraph remains the same. The most fundamental paraphrase is a short summary which expresses the major topic and the important ideas of a passage.

The concept of paraphrase can also be applied to a single idea within a passage. An important idea in a passage can be expressed in different ways. Sometimes information from different parts of a passage must be integrated by the reader to determine the underlying idea. The skilled reader can pull together information from different locations to determine the topic and major ideas of a passage. A reader who has understood a major point of a passage will recognize that idea later, even if it is expressed in a different form. He will recognize differences in expression which change the meaning of major points.

This section of the unit gives the student practice in identifying the major topic and important ideas of a passage, and in recognizing ideas from a passage when they are stated in different form.

Objectives:

_____ The child can read a passage and identify the major topic.

_____ The child can specify how the topic of a passage has been developed.

_____ The child can read a statement based on an important idea from a passage, and decide whether that statement is accurate.

    when the statement is an acceptable paraphrase

    when the statement changes important elements of the idea

____ The child can identify the parts of the passage which communicate a particular idea.

    when the idea comes from one sentence in the passage

    when the idea comes from several consecutive sentences

    when the idea comes from different parts of the passage

70. Have the student read a short passage. Ask him to figure out what the passage is talking about. After he has finished reading, ask him to select a phrase which tells what the passage is mainly about. (See page 200 of the materials.) "What the passage is mainly about" often has two parts. First, the passage is about some topic concept. In most passages this topic concept is a person, place, or thing. The story on page 200 is about hot dog buns. A passage is then built by giving some kind of information about the topic concept. The kind of information given can often be described by the question words -- who, what, where, when, why, how. The story on page 200 is about how the hot dog bun improved the hot dog. The important ideas of a passage are usually those which elaborate this information.

71. Have the student read a short passage. Ask him to figure out what the passage is talking about. After he has finished reading, ask him to write a phrase which tells what the passage is mainly about. The phrase should identify the topic concept and tell how it is developed.

72. Talk with the students about the different ways in which a topic can be developed. What are the different things about a clock, for instance, that people might be interested in knowing about? Let each student choose one kind of information about clocks and write a paragraph developing the topic in that way. Then have the students trade papers and decide what the passage is mainly about. A longer essay about the topic could be formed by putting together the paragraphs written by different students.

73. Take a passage and write each sentence on a separate strip of paper. (See page 205 of the materials.) Let a student sort the sentences into groups according to what is being talked about in each sentence, or according to the kind of information about the topic given in each sentence.

74. Take a passage and number each sentence. Have the child identify by number all of the sentences which have to do with a particular topic or give a particular kind of information. (See page 211 of the materials.)

75. Introduce the children to basic concepts in outlining. The phrase which tells what the passage is mainly about is a good major heading in an outline. Important ideas which elaborate on that topic can be expressed as points under the major heading. (See page 208 of the materials.)

76. A more extended outline can be made by combining sections which give different kinds of information about the major topic. (See pages 202 through 206 of the materials.)

77. Have the children read a passage. Then give them a statement which expresses an important idea from the passage. Have the students locate the part of the passage which gives them that information. They might underline the appropriate parts of the passage. (See page 212 of the materials.)

78. Have the students locate the part of a passage which communicates an important idea. Choose an idea which is not expressed in just one sentence of the passage but comes from combining several sentences. The sentences might occur one after another in the passage or might be in separate parts of the passage. Help the students see how they have integrated information to get the underlying idea.

79. Have the students read a passage. Then select a sentence or a set of sentences which express a basic idea. Ask the children to paraphrase the sentence(s), to express the idea in other words. Be sure they include in the paraphrase the important information, particularly how the sentences relate to the major topic.

80. Have the students read a passage. Then give them a statement based on an important idea in the passage. Ask them whether the statement gives the same information as that in the passage (is an acceptable paraphrase) or changes the information in the story. (See page 200 of the materials and some of the others.) If the student decides incorrectly, ask him to find the part of the passage which gives the information. Talk about why changes are important to the meaning of the passage.

Read the story carefully. After the story are two kinds of questions.

When hot sausages were first served at the New York ball park, they were lifted directly from the boiling water and eaten without a bun. Customers kept switching them from hand to hand to keep the hot sausages from burning their fingers. Then, in 1904, at the World's Fair, one smart man who sold sausages began to wrap his sizzling hot dogs in bread rolls. Customers liked his idea because the rolls kept them from burning their fingers. The rolls also improved the taste, especially when the hot dogs were drenched with mustard, catsup, or relish. The fame of the hot dog in a bun spread so rapidly that it soon became one of America's favorite foods.

This story is mainly about:

1. who first used hot dog buns
2. why hot dogs taste better with mustard
3. how hot dog buns improved the hot dog
4. why the fame of the hot dog spread rapidly

SAME DIFFERENT At the World's Fair one smart customer got the idea of wrapping his hot dog in a bun.

SAME DIFFERENT Buns improved the taste of the hot dog.

SAME DIFFERENT The bun was useful because it kept the hot dog warm.

Read the story carefully. After the story are two kinds of questions.

Music lessons are fun -- for some people. Wolfgang Mozart was one boy who couldn't wait to start. When he was three years old, he used to join in his older sister's lessons. And when he was five, he was making up his own music. Some people didn't believe that a little boy could write such beautiful music. They thought it must be a trick. They thought his father had written it. So they tried an experiment. They told Wolfgang to stay in a room all by himself for a week. Somebody watched the room all the time to be sure that no one talked to him. At the end of the week, he had written a brand new piece of music for the church choir. After that, people believed that Wolfgang could write beautiful music.

This story is mainly about:

1. how people proved that a little boy could write music
2. why music lessons can be fun
3. how Mozart learned to write church music
4. how Mozart's father tricked people.

SAME	DIFFERENT	Mozart started playing the piano when he was 10 years old.
SAME	DIFFERENT	People talked to Mozart while he was writing music to make sure that he really did it himself.
SAME	DIFFERENT	People finally believed that Mozart could write music.

What if you had a first name but no last name? If your first name were Akajimabamaboo, everyone would know who you were, because probably no one else would have that name. But what if your first name were Bob or Mary? There are so many people named Bob or Mary that everyone would get confused.

A very long time ago that's the way it was. People had only one name. As there got to be more and more people in the world it got harder and harder to tell them apart. So people began making up last names for themselves.

This passage is mainly about:

1. how many people are named Bob
2. why Akajimabamaboo is a good name
3. why people need last names
4. how people named Mary get confused

SAME DIFFERENT People have always had first names and last names.

SAME DIFFERENT If each person could have a different first name, we wouldn't need last names.

SAME DIFFERENT We need last names so we can tell people apart.

People chose last names in different ways. Sometimes in choosing a last name a man would think about the kind of work he did. If he was a cook, he might say "I am Tom, the cook." Or just plain Tom Cook. One common last name is Smith, which is short for Blacksmith. A blacksmith is a man who shoes horses and heats and pounds and bends iron to make things. Today there aren't many blacksmiths, but there are lots of Smiths in the phone book.

Other people picked a last name that told about the place where they lived. Someone who lived on a hill could be called "Joe on the hill," or just Joe Hill. A woman named Ann Lake probably comes from a family that once lived near a lake.

People chose last names in different ways.

Sometimes in choosing a last name a man would think about the kind of work he did.

If he was a cook, he might say "I am Tom, the cook."

Or just plain Tom Cook.

One common last name is Smith, which is short for Blacksmith.

A blacksmith is a man who shoes horses and heats and pounds and bends iron to make things.

Today there aren't many blacksmiths, but there are lots of Smiths in the phone book.

Other people picked a last name that told about the place where they lived.

Someone who lived on a hill could be called "Joe on the hill," or just Joe Hill.

A woman named Ann Lake probably comes from a family that once lived near a lake.

This passage is mainly about:

1. where the name Smith came from
2. how people chose last names
3. why Tom was a good cook
4. how a last name came from the place a person lived in

SAME DIFFERENT A man might choose the name Smith to tell where he lived.

SAME DIFFERENT A name like Tom Cook is another way of saying Tom, the cook.

SAME DIFFERENT Someone might have picked the last name Lake to tell where they lived.

Outline:

I.

A.

B.

ways people chose last names

names that tell the kind of work done

names that tell where a person lives

Many people have had festivals or celebrations at the beginning of each season. The most popular is a May Day festival to celebrate the coming of spring. The warm weather and the sunshine make people glad to get outdoors. Two interesting May Day festivals are those of the English and the Scandanavians.

The English celebrate May Day by electing a May queen. She was chosen just before May Day in a special contest. On May Day she sat on a platform and waved and smiled at the crowd. Englishmen went "a-Maying" to gather baskets of flowers to decorate her throne.

In the Scandanavian countries, the custom was to put up a May pole. A strong young tree was planted in the middle of a meadow. Streamers of cloth and ribbon were hung from the pole. Then the people grabbed the streamers and danced around the pole until they were all tired out.

This story is mainly about:

1. who elected a queen on May Day
2. how the custom of the May pole developed
3. why people celebrate May Day
4. how May Day was celebrated by the English and the Scandanavians.

SAME DIFFERENT A May Day festival is held in the middle of the summer.

SAME DIFFERENT The Scandanavians elected a queen to watch over the celebration.

SAME DIFFERENT One May Day custom was to dance around a May pole.

Outline:

I.

A.

B.

The English choose a May queen
How May Day was celebrated
The Scandanavians dance around a May pole

Outline

I.

A.

B.
1.
2.

The Scandanavians danced around a May pole
The celebration of May Day
The English chose a May queen
Why May Day is celebrated -- to welcome spring
How May Day is celebrated

Can you remember when a friend wanted something you had? And you wished you had something that belonged to your friend? And then the two of you traded? Long ago, before there was any money everyone traded the things they didn't need for the things they wanted. Suppose you had two cows but no hay to feed them. You might find someone who would trade you some hay for one of your cows. Then both of you would have what you needed.

But sometimes trading didn't work so well. Sometimes traders couldn't decide just how much hay one cow was worth. Even when they did agree, there were problems. They might decide the hay was worth only half a cow. But since half a cow is really no cow at all, the man would still have to give a whole cow for the hay. Trading was sometimes disappointing. And it was often hard work.

One problem with trading was that the hay might not be worth a whole cow.

There was still another bothersome thing about trading - it might take a very long time. Suppose Tom had something you wanted but you didn't have anything he wanted. You might have to trade different things with different people before you got something Tom wanted.

For the man who has a cow, it might take so long that the cow wouldn't be worth trading. And a man's hay or grain might grow moldy and spoil.

Trading something you have for something you want can be fun. But long ago people learned a better way. They learned to use something that is easy to carry, something that never grows old and spoils, something that can be sorted and counted and that everybody wants - something called money.

(1) When explorers go to Antarctica, they always look forward to seeing the penguins. (2) They enjoy watching the penguins do funny things. (3) The penguins slide across the ice on their stomach. (4) They take rides on floating chunks of ice. (5) And they chase each other through the water.

(6) The penguins seem to be curious about the explorers, too. (7) Groups of penguins sometimes follow men around. (8) The birds act as though they want to see what's going on. (9) Once, several years ago, a submarine came to Antarctica. (10) A penguin swam out to it and hopped aboard, to "welcome" the explorers to Antarctica.

1. Circle the numbers of the sentences which tell about how the explorers like to watch the penguins.

   1 2 3 4 5 6 7 8 9 10

2. Circle the numbers of the sentences which tell about what funny things the penguins do.

   1 2 3 4 5 6 7 8 9 10

3. Circle the numbers of the sentences which tell about why a penguin jumped on a submarine.

   1 2 3 4 5 6 7 8 9 10

4. Circle the numbers of the sentences which show that the penguins are curious about the explorers.

   1 2 3 4 5 6 7 8 9 10

This story is mainly about:

1. where you should go to see penguins
2. how explorers and penguins watch each other
3. what funny things penguins do
4. how penguins welcome explorers to Antaractica

EXAMPLE

READ the story below.

Bob and Frank were playing baseball with their friends. Bob's team was at bat. When Bob's turn came, the bases were loaded. Bob really wanted to get a hit, and he swung hard. The ball sailed over the fence, and four runs were scored. Bob was very happy.

NOW read the sentence in the box. Part of the story means the same as the sentence in the box. It may be part of a sentence, or a whole sentence, or more than one sentence. Underline whatever part of the story means the same thing as the sentence in the box.

Bob wanted to get a hit, so he gave the bat a good swing.

READ the story below.

Sparks fly from burning torches and the fiery flames of huge bonfires reach up toward the sky! It is the Indian fire dance! Around and around the fire the Indians leap almost as high as the flames themselves. As the Indians dance closer and closer to the fire, you can see that their bodies are painted. The bright colors glow in the fire light. Wherever you look, figures leap and dance. Sparks seem to explode in the sky.

NOW read the sentence in the box. Underline whatever part of the story means the same thing as the sentence in the box.

The painted bodies of the Indians danced closer and closer to the flames.

READ the story below.

Sparks fly from burning torches and the fiery flames of huge bonfires reach up toward the sky! It is the Indian fire dance! Around and around the fire the Indians leap almost as high as the flames themselves. As the Indians dance closer and closer to the fire, you can see that their bodies are painted. The bright colors glow in the fire light. Wherever you look, figures leap and dance. Sparks seem to explode in the sky.

NOW read the sentence in the box. Underline whatever part of the story means the same thing as the sentence in the box.

Wherever you look, figures leap upward, almost as high as the flames themselves.

READ the story below.

A mean grouchy giant once lived on a beach in Hawaii. He frightened people with his bellowing and hollering. He even used to stick out his long tongue at people. But one day a good giant killed the grouchy giant and flung him to the sharks. The sharks ate all of the grouchy giant except his tongue. It was too tough even for their sharp teeth. So the sharks left the tongue of the grouchy giant on the beach, where it turned into black rock. Today a long tongue of black rock -- all that's left of the grouchy giant -- juts into the water along the beach.

NOW read the sentence in the box. Underline whatever part of the story means the same thing as the sentence in the box.

The sharks couldn't eat the tough tongue, so they left it on the beach.

READ the story below.

A mean grouchy giant once lived on a beach in Hawaii. He frightened people with his bellowing and hollering. He even used to stick out his long tongue at people. But one day a good giant killed the grouchy giant and flung him to the sharks. The sharks ate all of the grouchy giant except his tongue. It was too tough even for their sharp teeth. So the sharks left the tongue of the grouchy giant on the beach, where it turned into black rock. Today a long tongue of black rock -- all that's left of the grouchy giant -- juts into the water along the beach.

NOW read the sentence in the box. Underline whatever part of the story means the same thing as the sentence in the box.

All that's left of the grouchy giant is a long tongue of black rock on a beach in Hawaii.

READ the story below.

Most people don't live in a house that shrinks and swells. But some people in Africa do. They make these houses with grass mats. When it rains, the grass swells until the mats become so tight that the rain can't soak in. But when the sun comes out, the grass shrinks and it makes holes in the mats for the breezes to blow through. So these grass houses are very practical in the rain and in the sun.

NOW read the sentence in the box. Underline whatever part of the story means the same thing as the sentence in the box.

Some people in Africa live in houses that shrink and swell.

READ the story below.

Most people don't live in a house that shrinks and swells. But some people in Africa do. They make these houses with grass mats. When it rains, the grass swells until the mats become so tight that the rain can't soak in. But when the sun comes out, the grass shrinks and it makes holes in the mats for the breezes to blow through. So these grass houses are very practical in the rain and in the sun.

NOW read the sentence in the box. Underline whatever part of the story means the same thing as the sentence in the box.

In the rain the grass mats swell up tight and the water can't get through.

Milk is a drink that has been used for a long time. The first milk that was used came from horses. People in ancient Turkey lived by traveling from place to place on horseback. Since they always had their horses with them horse's milk was readily available. One Turkish king kept a herd of over 10,000 horses to supply milk for his royal household. Jugs of horse's milk were passed around at each meal.

Horse's milk was also used in Russia. In the 1800's horse's milk became a dieting fad. Health resorts would bring in country girls to milk the horses. The fresh horse's milk was then served to the dieters. They liked its interesting taste.

This story is mainly about:

1. why the Turkish used horse's milk
2. how horse's milk has been used by the Turkish and the Russians
3. When milk was first used
4. how horse's milk was used for dieting

SAME DIFFERENT The people in Turkey used horses just for their milk.

SAME DIFFERENT The first milk used was horse's milk.

SAME DIFFERENT The people in ancient Turkey used horse's milk for a dieting fad.

Which Questions Does It Answer?

The information from many things you read can answer different kinds of questions. Read the sentences below. Decide whether the information will answer questions about any of the following: who? what? when? how? where? why? On the line, write your choice of words. Some sentences may be able to answer more than one question.

Example: Gold was discovered in California in 1849.

what where when

1. On January 9, 1971, a man baked a pizza 11 feet wide.

____

2. Two men from the Carry-All Moving Company pulled a piano slowly along the sidewalk with a rope.

____

3. The scientist stopped the experiment by turning off the electricity.

____

4. Last week, the schools were closed because of the flood.

____

5. Some people think that in the next 50 years they may be able to travel to the moon.

____

6. At 3 p.m., three fire engines were called to 64 Milton St. to put out a fire.

____

7. John Adams was the first President to live in the White House in Washington, D.C. He moved into it in 1800.

____

If you ever get a mouthful of ocean water, you'll find it's very saltly. How did it get this way? Rivers are the oceans' saltshakers. Almost every river in the world finally pours its waters into an ocean. While the river is running to the sea, it loosens some of the land and carries it along. The land is made up of rocks and soil, which contain minerals. One of these minerals is salt.

You can't taste the salt in river water because the river doesn't carry much salt at any one time. And you can't taste it in most lakes because as one river brings a little salt in, another river carries it out. It has taken rivers millions and millions of years to pour enough salt into the oceans to make ocean water taste salty.

Green plants need water in order to live. Plants need water to keep the leaves and stems firm. Most plants get water through the ground they are planted in. The roots reach down into the dirt and soak up the water. In the roots and stem of the plant there are tiny parts that fit together to form tubes. Water moves from the roots through these tubes to the stem. The water then moves into the leaves of the plant. These tubes do much the same thing for the plant that the water pipes of a house do for you.

A boy lies stranded on an icy ledge. Snow is falling on him. He cannot move. No man can climb to the ledge without falling. But a huge dog starts to creep toward the boy. When the dog reaches the boy, it lies down on top of him to keep him warm. Then, the dog starts to lick the boy's face. The boy wakes up and throws his arms around the dog's neck. He jumps on the dog's back and hangs on to its neck. And the dog takes the boy to safety.

This story is told about a Saint Bernard dog named Barry. Barry saved the lives of many people lost in the snowy mountains.

A cave can be a home for bats and rats, and crayfish and crickets. But some caves are homes for birds. One kind of a bird that lives in caves is the oilbird. Oilbirds sleep during the day and search for food at night. They are something like bats. They, like bats, have a special kind of radar. They screech, cluck, and squawk. These sounds bounce back to their ears to let them know things are in the way. That's why the birds can fly in the dark caves or during the night without bumping into things.

APPENDIX J

TEST GIVEN AS PRETEST
AND POST TEST FOR
THE FIFTH GRADE ETU
IN MATHEMATICS

PROBABILITY AND GRAPHING

General Directions:

Put your first and last name, your teacher's name, and the date in the box at the top of your answer sheet.

Make sure you understand the directions before you begin the test. Ask questions if there are any directions you don't understand.

The problems will be read to you one problem at a time so that you can work the problem after it is read.

Work as fast as you can. There may be problems you can't do because you haven't been taught how. If a problem is too hard, don't spend too much time on it. Make the most careful choice you can.

Do all your work on a piece of scratch paper, not on the test booklet.

Put all your answers on the answer sheet. Be sure your marks are clear. Mark only one answer for each problem. If you want to change an answer, erase your first answer completely.

Sample Problem:

1. How many cards are in a full deck of cards.

a. 32 d. 51

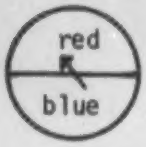
b. 42 e. 43

c. 52

Sample Answer Sheet:

A B C D E
1 Ⓣ Ⓕ ● ○ ○
A B C D E
2 Ⓣ Ⓕ ○ ○ ○

1. What is the probablity that the pointer on the spinner pictured below will stop on red?



A) 1 out of 2
B) 1 out of 4
C) 1 out of 1
D) 0 out of 1
E) none of these

---

2. A box contains 5 red balls and 2 blue balls. If you do not look in the box, what would be the probability that you would pick a red ball?

A) $\frac{5}{7}$
B) 3
C) $\frac{2}{7}$
D) 0
E) 1

---

3. If you toss a coin, what is the probability that it will land heads up?

A) 3 out of 4
B) 0 out of 1
C) 1 out of 2
D) 1 out of 1
E) none of these

---

4. The probability of drawing a card with a heart on it out of a full deck of cards is ________.

A) $\frac{13}{52}$
B) 0
C) 1
D) $\frac{1}{52}$
E) none of these

---

5. Getting a "tail" and getting a "head" when you flip one coin have equal probabilities. We say that these two events have ____________________.

A) nothing in common
B) unlikely chances
C) equal chances
D) impossible chances
E) none of these

---

6. One of two dice is called a die. A die has the numerals 1, 2, 3, 4, 5, and 6. Getting one cf these numerals when you roll the die is a __________ event.

A) certain
B) uncertain
C) unlikely
D) impossible
E) none of these

---

7. Getting a "7" when you roll a single die is a(n) __________ event.

A) impossible
B) certain
C) likely
D) uncertain
E) none of these

8. Rolling a "5" on the single die in one try is an ____________ event.

A) impossible
B) uncertain
C) certain
D) likely
E) none of these

---

9. A bag contains 7 marbles. Each is a different color. If you take out one marble without looking, the chance that it will be red is $\frac{1}{7}$. What is the chance that it will not be red?

A) $\frac{1}{7}$
B) 1
C) $\frac{4}{7}$
D) $\frac{6}{7}$
E) none of these

---

10. The weatherman says that the chance of rain is 40 percent. What is the probability that it will not rain?

A) $\frac{40}{100}$
B) 2 percent
C) $\frac{30}{70}$
D) 60 percent
E) none of these

---

11. There is no way to roll a "10" using a single die. So we say that the probability of getting a "10" with a single die is ______.

A) 50%
B) 0
C) 100%
D) 1
E) none of these

---

12. The probability of getting either 1, 2, 3, 4, 5, or 6 when you roll a single die is 1, because one of the numbers has to come up. This is called a _____________ event.

A) certain
B) impossible
C) uncertain
D) unequal
E) equal

---

13. Rolling a "12" with one die is an impossible event. This means that:

A) it will happen
B) there is no "12" on a single die
C) it is likely to happen
D) there is a "12" on a single die
E) none of these

14. A jar contains two white marbles and three red marbles. On your first try the probability of picking a red marble out of the jar without looking is ________.

A) greater than 1

B) greater than 100

C) greater than 0, but not more than 1

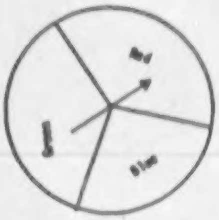
D) less than 0

E) none of these

---

15. Look at this spinner. If you spin it, the possible outcomes are red, green, or blue.

The total sum of the probabilities of the outcome is ____________.



A) 0

B) 1

C) 3

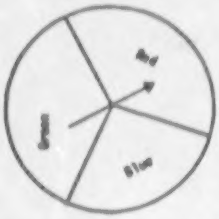
D) $\frac{1}{3}$

E) none of these

---

16. Look at this spinner.

If you spin it, getting a "yellow" is __________.



A) certain

B) impossible

C) uncertain

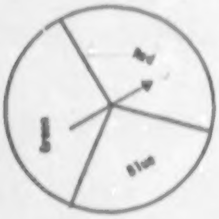
D) unequal

E) equal

---

17. Look at this spinner.

If you spin it, you would be certain to _________.



A) get a blue

B) get a red

C) get a yellow

D) get a red, a blu or a green

E) get none of thes

6

18. A probability of $\frac{1}{2}$ for heads tells us that if you toss a coin many times you can expect to get heads:

A) none of the time

B) half of the time

C) one-fourth of the time

D) all of the time

E) once

---

19. A box contains 11 marbles of different colors. Some are red, some are blue, and some are green.

The probability of choosing a green marble is $\frac{4}{11}$, choosing a red marble is $\frac{5}{11}$, and choosing a blue marble is $\frac{2}{11}$. How many marbles of each color are in the box?

A) 5 blue, 3 green, and 2 red

B) 4 green, 5 red, and 2 blue

C) 2 green, 5 red, and 4 blue

D) 11 red

E) none of these

---

20. If the probability of getting red on a spinner is equal to $\frac{1}{6}$, which of the following is true:

A) the spinner has 6 equal sections only one of which is red.

B) the spinner is all red

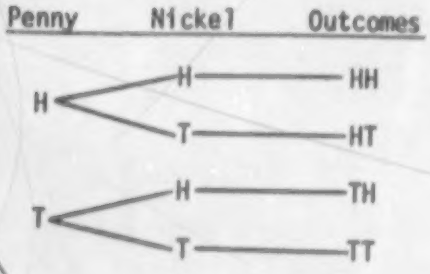
C) there is no red on the spinner

D) the spinner has 6 equal sections all of which are blue.

E) none of these

---

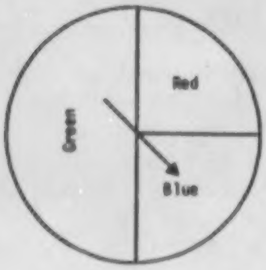
21. If you toss 2 coins, there are four possible ways they can land. Does the diagram show all of the ways? (H=heads T=tails)



A) Yes

B) No

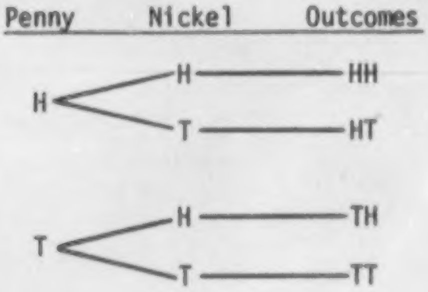
22. Look at this spinner. What are the possible outcomes when we spin it once?



A) green
B) green, red or blue
C) red
D) blue
E) none of these

---

23. This tree diagram illustrates the possible outcomes when you toss two coins, a penny and a nickel, one time each. (H=heads T=tails)



The probabilities of the four outcomes are ______________

A) $\frac{1}{4}$, $\frac{1}{3}$, and 1
B) 0
C) 1
D) $\frac{1}{4}$, $\frac{1}{4}$, $\frac{1}{4}$, $\frac{1}{4}$,
E) none of these

---

24. When you roll one die, there are __________ possible outcomes.

A) 1
B) 3
C) 0
D) 6
E) none of these

---

25. What type of graph would you use to show the growth of the population of a country?

A) bar graph
B) circle graph
C) line graph
D) all of these
E) none of these

26. You toss a coin twice. What is the probability that you will get heads on both tosses?

A) 1 out of 4
B) 1 out of 2
C) 3 out of 4
D) 1 out of 36
E) none of these

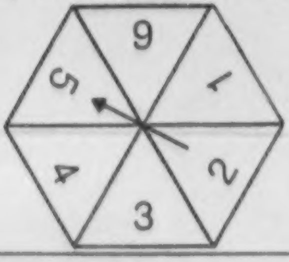
---

27. You roll two dice. What is the probability that you will roll two sixes?

A) 1 out of 4
B) 1 out of 36
C) 2 out of 5
D) 0
E) 1

---

28. Look at the spinner. If you spin it once, what is the probability that it will stop on an even number?



A) 0
B) 1
C) $\frac{3}{6}$
D) $\frac{1}{5}$
E) none of these

---

29. If you roll a die, the probability of getting a 4 is $\frac{1}{6}$ or 1 out of 6. What is the probability of not getting 4?

A) $\frac{1}{2}$
B) $\frac{5}{6}$
C) $\frac{4}{12}$
D) $\frac{1}{6}$
E) none of these

---

30. Your friend writes the numerals 1, 2, 3, 4, 5, and 6 on a piece of paper. He/she says, "I am thinking of one of these numbers." What is the probability that he/she is thinking of an odd number.

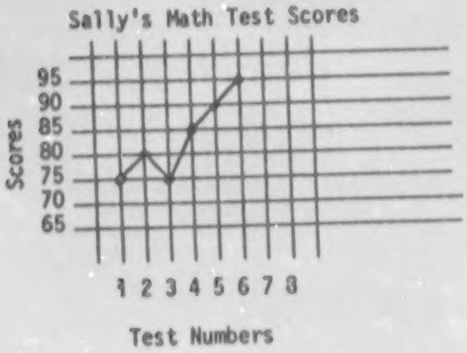
A) 1
B) $\frac{1}{6}$
C) $\frac{3}{6}$
D) $\frac{2}{6}$
E) none of these

---

31. If you toss two coins once, the possible outcomes will be ________. (If H = heads and T = tails.)

A) H,T,H,or T
B) HH,HT,TH, or TT
C) HH or TT
D) all of these
E) none of these

This is a graph of Sally's math test scores for her first six tests. Use it to answer questions 32 through 35.



32. How many points does each square on the graph represent?

A) 5
B) 10
C) 15
D) 20
E) none of these

---

33. On which two tests did Sally have the same score?

A) 1 and 4
B) 1 and 3
C) 4 and 5
D) 5 and 6
E) none of these

---

34. What was Sally's average (mean) score for the six tests?

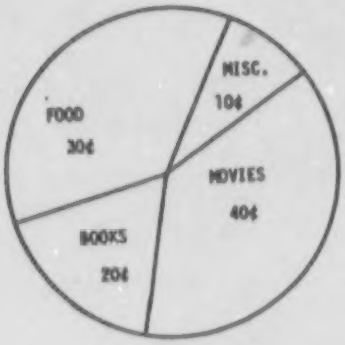
A) 80
B) 90
C) 83
D) 100
E) none of these

---

35. What was the range of her scores?

A) 75 - 95
B) 65 - 95
C) 70 - 90
D) 75 - 80
E) none of these

This circle graph shows how Jim divides his allowance. Use it to answer questions 36 through 38.



36. How much is Jim's allowance?

A) $.75 D) $2.00
B) $2.20 E) none of these
C) $1.00

37. On which item does he spend the most money?

A) Food D) Misc.
B) Movies E) none of these
C) Books

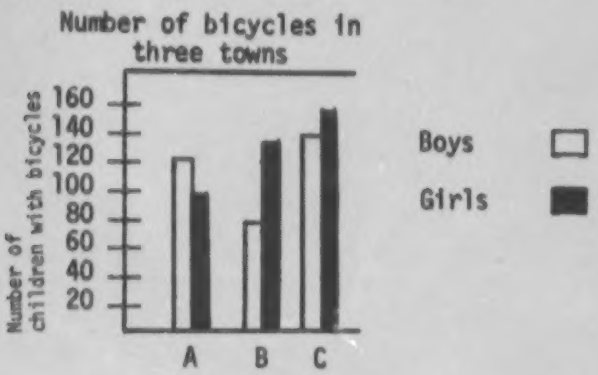
38. What part of his total allowance does Jim spend on food?

A) $\frac{2}{10}$ D) $\frac{1}{2}$
B) 30% E) none of these
C) 20%

39. What kind of a graph would you use to show the heighth of the mountain peaks of the world?

A) bar graph D) all of these
B) circle graph E) none of these
C) line graph

This is a graph of the number of bicycles in three towns. Use it to answer questions 40 through 42.



40. Which town has the greatest number of boy's bicycles?

A) Town B
B) Town C
C) Town A
D) all towns are the same
E) none of these

---

41. What is the total number of bicycles in Town C?

A) 90
B) 130
C) 160
D) 92
E) none of these

---

42. This is a ________________ graph.

A) circle
B) bar
C) line
D) picture
E) none of these

---

43. What kind of graph would best show a comparison of the points scored by each player on your basketball team?

A) bar graph
B) picture graph
C) circle graph
D) all of these
E) none of these

---

44. If you wanted to show the trend of points scored for each game through the season, what kind of graph would you use?

A) bar graph
B) line graph
C) circle graph
D) all of these
E) none of these

---

45. If you want to make a graph showing a comparison of the heights of the major mountain peaks of the world, what information would you NOT need to collect?

A) names of major cities of the world
B) height of major mountain peaks
C) name of major mountain peaks
D) none of these

---

46. What type of graph would you use to show the distances some students threw a football?

A) bar graph
B) circle graph
C) line graph
D) all of these
E) none of these

---

47. Your basketball team has been winning many games. You want to find out how many points are scored per player so that you may give an award to the highest scoring player. What information would you need to do this?

A) list of places games were played
B) total points scored per game
C) list of players and points socred per player for each game
D) number of free throws per game
E) none of these

---

48. What type of graph would you use to show how the government divides tax money?

A) bar graph
B) circle graph
C) line graph
D) all of these
E) none of these

APPENDIX K

TESTERS MANUAL
FOR ADMINISTRATION OF THE
PRETEST AND POST TEST
ACCOMPANYING THE FIFTH GRADE
ETU IN MATHEMATICS

TESTER'S MANUAL

Experimental Teaching Unit

Mathematics - Grade 5

Probability and Graphing

General Information

At the beginning of the test session, give the teacher a copy of the test. Say something like "YOU MIGHT WANT TO LOOK THROUGH A COPY OF THE TEST." Let the teacher keep the test during the test session, but be sure to get the test back at the end of the session. Do not let the teacher keep a copy of the test. Explain to the teacher that the Unit should cover the general area of probability and graphing, rather than the specific items on the test. Point out that the Materials pages in the Unit are very similar to the test items.

During the testing, it will be necessary to circulate around the room, making sure that the students have understood the questions and are using the answer sheet correctly. A student who is confused may raise his/her hand for help. If this happens, repeat the question (or particular part) and the answers clearly. You may also point out charts or diagrams that refer to the question, but do not help further with the answers.

The teacher may want to help circulate and answer questions. This is permissable as long as the teacher understand that he/she may only repeat questions and answers clearly and point out charts and diagrams. No further help is to be given.

Be sure at all times when helping students that they are working the answer sheets correctly. Some students may find some of the problems difficult and frustrating. Try to encourage all students to figure out what they can. Say something like this:

> I KNOW SOME OF THE PROBLEMS ARE DIFFICULT. YOU ARE HELPING US TO FIND OUT WHICH THINGS ARE HARD TO DO AND WHICH ARE EASY TO DO. TRY TO FIGURE OUT WHATEVER YOU CAN ON YOUR OWN. DO YOUR BEST.

This is not a timed test. All students should have enough time to finish. Sometimes there are students who hold up the rest of the class. After you read each question and the set of answers, wait a reasonable length of time, then go on. It is important to keep things moving, so that the rest of the class doesn't become restless, and so that slower students do not become frustrated. Watch the students as they answer and use your best judgement as to the best pacing. If a faster student asks you if he/she may go on, tell him/her that if he/she feels he can read the test and will not disturb others that he/she may go ahead at his/her own rate.

Mathematics - Grade 5

Before beginning testing, make sure that desks are clear and that students are seated some distance apart. Ask the teacher to write his/her name on the board. Also be sure that you have enough pencils, answer sheets, scratch paper, and test booklets for all students present.

> GOOD MORNING. TODAY WE WOULD LIKE YOU TO DO SOME MATHEMATICS PROBLEMS. WE WANT TO FIND OUT WHAT THINGS ARE EASY AND WHAT THINGS ARE HARD FOR STUDENTS IN YOUR GRADE TO DO. YOU CAN HELP US BY DOING YOUR BEST ON THE PROBLEMS.
>
> IN ORDER TO DO THE WORK YOU WILL NEED A PENCIL, AN ANSWER SHEET, AND A BOOKLET OF PROBLEMS. MAKE SURE YOUR PENCIL IS SHARP AND HAS AN ERASER. NOW WE WILL PASS OUT THE ANSWER SHEETS. ON THE ANSWER SHEET FILL IN YOU FIRST AND LAST NAME, THE DATE, YOUR TEACHER'S NAME, AND SCHOOL IN THE BOX AT THE TOP. BESIDE YOUR NAME WRITE P-R-E. YOUR TEACHER'S NAME IS ON THE BOARD.
>
> WHEN YOU FINISH, LOOK UP AT ME SO I WILL KNOW YOU ARE READY TO BEGIN.

Pass out pencils, if needed, and answer sheets. Be sure information is filled in correctly and each student's answer sheet is complete.

> NOW WE WILL PASS OUT THE BOOKLETS OF PROBLEMS AND SCRATCH PAPER. DO NOT OPEN THE BOOKLET. LEAVE IT FACE UP ON YOUR DESK. ALSO, PLEASE DO NOT WRITE ON THE BOOKLET. YOU WILL WRITE YOUR ANSWER ON YOUR ANSWER SHEET AND DO YOUR WORK ON SCRATCH PAPER.
>
> LET'S READ THE GENERAL DIRECTIONS ON THE FRONT OF THE TEST TOGETHER. READ SILENTLY WHILE I READ OUT LOUD.
>
> "PUT YOUR FIRST AND LAST NAME, YOUR TEACHER'S NAME, AND THE DATE IN THE BOX AT THE TOP OF YOUR ANSWER SHEET." YOU HAVE ALREADY DONE THIS. IS THERE ANYONE WHO HAS NOT?

Check to make sure all students have recorded this information on the answer sheet.

> "MAKE SURE YOU UNDERSTAND THE DIRECTIONS BEFORE YOU BEGIN THE TEST. ASK QUESTIONS IF THERE ARE ANY DIRECTIONS YOU DON'T UNDERSTAND."

"THE PROBLEMS WILL BE READ TO YOU ONE PROBLEM AT A TIME SO THAT YOU CAN WORK THE PROBLEM AFTER IT IS READ."

"WORK AS FAST AS YOU CAN. THERE MAY BE PROBLEMS YOU CAN'T DO BECAUSE YOU HAVEN'T BEEN TAUGHT HOW. IF A PROBLEM IS TOO HARD, DON'T SPEND TOO MUCH TIME ON IT. MAKE THE MOST CAREFUL CHOICE YOU CAN."

REMEMBER THAT WE ARE TRYING TO FIND OUT WHICH THINGS ARE DIFFICULT AND WHICH ARE EASY, SO JUST DO YOUR BEST.

"DO ALL YOUR WORK ON YOUR PIECE OF SCRATCH PAPER, NOT ON THE TEST BOOKLET."

"PUT ALL OF YOUR ANSWERS ON YOUR ANSWER SHEET. BE SURE YOUR MARKS ARE CLEAR. MARK ONLY ONE ANSWER FOR EACH PROBLEM. IF YOU WANT TO CHANGE AN ANSWER ERASE YOUR FIRST ANSWER COMPLETELY. AFTER YOU ERASE AN ANSWER YOU DON'T WANT, BE SURE TO CLEARLY MARK YOUR NEW ANSWER."

ARE THERE ANY QUESTIONS?

After answering questions and when all are ready, do the sample problems.

LOOK AT THE BOTTOM OF THE FIRST SHEET OF YOUR BOOKLET. FIND THE SAMPLE PROBLEM. LET'S TRY THIS PROBLEM TOGETHER.

SAMPLE PROBLEM. 1. HOW MANY CARDS ARE IN A FULL DECK OF CARDS? (Pause) A. THIRTY-TWO B. FORTY-TWO C. FIFTY-TWO, D. FORTY-THREE. (Pause) THE CORRECT ANSWER IS C-FIFTY TWO. NOTICE THAT THE CIRCLE UNDER "C" ON THE SAMPLE ANSWER SHEET BELOW THE PROBLEM IS COMPLETELY COLORED IN. THIS IS HOW YOU SHOULD MARK YOUR ANSWER SHEET. COLOR COMPLETELY THE CIRCLE UNDER THE LETTER YOU WISH TO ANSWER FOR EACH PROBLEM. DO NOT MAKE ANY EXTRA MARKS. MARK ONE ANSWER FOR EACH PROBLEM. DO YOU ALL UNDERSTAND? ARE THERE ANY QUESTIONS?

After questions and when all are ready, begin the test.

NOW LET'S BEGIN. TURN TO THE FIRST PAGE OF PROBLEMS. REMEMBER THAT I WILL READ EACH QUESTION AND ALL POSSIBLE ANSWERS BEFORE YOU MARK EACH ANSWER ON YOUR ANSWER SHEET. FOLLOW ALONG AS I READ EACH PROBLEM.

1. WHAT IS THE PROBABILITY THAT THE POINTER ON THE SPINNER PICTURED BELOW WILL STOP ON RED?

   A. ONE OUT OF TWO
   B. ONE OUT OF FOUR
   C. ONE OUT OF ONE
   D. ZERO OUT OF ONE
   E. NONE OF THESE

NOW MARK THE LETTER OF THE CORRECT ANSWER OPPOSITE THE NUMERAL 1 ON YOUR ANSWER SHEET.

Pause until most students have finished.

2. A BOX CONTAINS......

Continue reading all questions and possible answer clearly to the students.

IMPORTANT READING NOTES

In reading test items, the following should be specially noted:

1. Read all fractions, e.g. 1/2 as "one-half", not one over two."

2. Read H,T (e.g. problems 21, 31) as "heads" and "tails and note the H = heads, T = tails code to the students.

3. Point out charts and diagrams that refer to problems (e.g. problems 15, 16, 17, 21, 22, 23, 28 and especially graphs for 32-35, 36-39, and 40-43).

Remember to adjust pacing as you read the test items. All students should be able to attempt all the items. Circulate as you give the test to make sure that students are marking answer sheets correctly. Remember, you may repeat questions and/or answers for clarity or pronounciation or you may point out charts and diagrams - that is the only help you may give.

Let those who finish early, stay quietly at their seats and do other work as long as they do not disturb others.

After you have finihsed reading the test and you see most have finished say:

WHEN YOU FINISH, CLOSE THE TEST BOOKLET AND PUT IT ON TOP OF YOUR ANSWER SHEET AT THE UPPER CORNER OF YOUR DESK.

Allow slower students to finish even after you have finished reading. Collect the test booklets and answer sheets. Be sure that the full name, teacher's name, school name, date and PRE are on the answer sheet.

THAT'S ALL FOR TODAY! THANK YOU VERY MUCH!

CHANGES FOR POSTTEST

Change the opening speech to:

GOOD MORNING. YOU PROBABLY REMEMBER A COUPLE OF WEEKS AGO YOU DID SOME MATHEMATICS PROBLEMS. WE WOULD LIKE YOU TO HELP US AGAIN BY DOING SOME OF THEM OVER AGAIN. SOME MAY SEEM EASIER THIS TIME, SOME MAY NOT. DON'T WORRY ABOUT WHAT YOU DID BEFORE. JUST THINK ABOUT THE BEST ANSWERS FOR EACH QUESTION. IT IS IMPORTANT THAT YOU WORK CAREFULLY.

NOW WE WILL PASS OUT THE ANSWER SHEETS. WRITE YOUR FIRST AND LAST NAME, YOUR TEACHER'S NAME, YOUR SCHOOL, AND THE DATE IN THE BOX AT THE TOP OF THE ANSWER SHEET. BESIDE YOUR NAME WRITE POST.
WE WILL NOW PASS OUT THE TEST BOOKLETS. LET'S READ THE GENERAL DIRECTIONS AND WORK THE SAMPLE PROBLEM TOGETHER TO MAKE SURE EVERYONE UNDERSTANDS CLEARLY BEFORE WE BEGIN THE TEST.

REMEMBER THAT I WILL READ ALL QUESTIONS AND POSSIBLE ANSWERS BEFORE YOU ANSWER EACH ONE.

Make no secret of the fact that the test is the same. But encourage the students to do their best work this second time. Ask them to help us out, and stress that it is important that they work carefully, even though they've done it before.

The test itself is given basically the same way. Since the students are familiar with the format, it might be possible to go through the item more quickly, but pace according to the students and allow all to attempt all problems.

APPENDIX L

THE FIFTH GRADE
ETU IN MATHEMATICS

Experimental Teaching Unit

Fifth Grade

MATHEMATICS

Developed by

Teacher Education Division
Far West Laboratory for
Educational Research & Development
1855 Folsom Street
San Francisco, CA 94103

Introduction to the Unit

This Experimental Teaching Unit is intended to give students some practice in important mathematics skills. There are two sections to the unit, each of which deals with slightly different skills.

For each section the following things are included in this packet:

(1) a brief overview of the skill area
(2) a list of performance objectives for the students
(3) a set of sample instructional materials (you may use those included, select some from another source, or create your own)
(4) some suggestions on ways to use the materials and or other related activities.

Your students will be both pre- and post-tested on many of the objectives listed in this unit. To keep the testing to a minimum not all of the objectives are tested directly. Individual scores on the pretest will be provided for you.

Please spend about 40 minutes each day on work related to these objectives. This means that a student working on unit activities should spend no more than about 40 minutes total during the day.

There are many different ways of organizing the materials and of relating one objective to another. Many exercises can be planned to cover more than one objective. If you wish, objectives from different areas can be included in the same lesson. We are interested in the variety of ways to teach these mathematics skills. You may teach as much of the unit to as many of your students as you wish, and in any manner you choose.

As much as possible, please keep track of what materials and activities you use to teach the unit. To help you do this, please follow these procedures:

(1) Each of the two sections in the ETU is composed of a set of instructional objectives.
    (a) For each section, select the objectives you plan to use.
    (b) Arrange the objectives in the order in which you plan to use them and place the appropriate number in the space provided. (You will use this number to identify each objective on your teaching record, so do this before you begin the unit.)
(2) Use the Daily Teaching Record, to keep track of the instructional objectives and the materials or activities you focus on each day.

At the end of the unit we would like to get information from you on questions like:

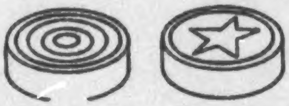
(1) What materials did you use (either from the packet or of your own devising)?
(2) In what order were objectives and materials used?
(3) Which materials/activities worked well and which less well?
(4) What was the reaction of the children to the unit?
(5) What procedures did you use for teaching different objectives?

A questionnaire will be provided. We hope you, as teachers, will feel free to try out different approaches to teaching the unit.

OVERVIEW: About Probability

I.

Consider a checker that has a star on one side and a circle on the other:



If we flip the checker in the air once and let it fall on a table, will the star be up or will the circle be up? Clearly, there are only two possibilities: either the star will be up or the circle will be up. (We assume throughout that the checker does not land on its edge, and that the object used is perfectly balanced, or "honest.")

Since only one of two possible results can be obtained by flipping a checker once (a star or a circle), we can express this by the ratio 1 out of 2, or 1/2. This ratio states that there is one chance out of two possibilities that the star will come up (or, equally likely, one chance out of two possibilities that the circle will come up). The ratio 1/2 is an expression of the probability that a star (or a circle) will be obtained by flipping the checker once.

Obtaining a star is one "event," and obtaining a circle is another "event." In one toss of the checker, only one of these two events can occur, and the two possible events are equally probable.

On one toss:

1. The probability of obtaining a star is 1/2 (one chance out of two possibilities).

2. The probability of obtaining a circle is 1/2 (one chance out of two possibilities).

Note that 1/2 also means one-half of the total events.

Probability, then is a numerical measure of the chance that a particular event will occur, compared with the total number of events that could possibly occur.

II.

We use probability in making predictions in our everyday lives. Probability is a concept inherent in such statements as those below. Notice that ratios like those described above as still understood in these statement (e.g. 60% might mean "6 out of 10").

a. "There is a 60% possibility of rain today."
b. "Seven out of 10 school children enjoy drinking milk."
c. "Nearly as much ice-cream is sold in winter as during the summer months.
d. "All the people in the town want an hourly bus service."

e. "Super cars travel 46 miles for every gallon of petrol."
f. "Mrs. Jones says 'Tough' staircarpet is the best. She has had 'Tough' carpet on her stairs for 20 years."
g. "Two out of 3 mothers feed their babies on Growup."
h. "'Floorsmear' makes you floor twice as shiny as any other polish."
i. "'Chloro' washes whiter."

From such statements as these, lively discussions can take place, and questions such as the following can be asked:

-- Is it possible to check the statement? If so, how can I do this?

-- If it is not, should we reject it as meaningless?

-- If it is, how can we verify it?

-- Is the information adequate and sound enough for the general truth of the statement to be accepted?

When we examine the nine statements closely, we can raise all sorts of questions about their validity. For instance,

-- In (a), how often has the weatherman's predictions been correct? On what is he basing his prediction?

-- In (b), would information from all the schools in the area give a result which is likely to be more accurate than from one school only?

-- In (f), children may ask such questions as:

> 'Has Mrs. Jones a family' If so, how many children were there in the family? Children wear out carpets! True or false?
>
> Has Mrs. Jones ever tried any staircarpet other than 'Tough'? She says 'Tough' is the best!
>
> And even: Is there really a Mrs. Jones, or has she been invented?

-- In (h), 'When do you know the floor is twice as shiny?'

-- (I) can be discussed and dismissed immediately as meaningless.

Statistics can be misleading, as evidenced in the 9 statements above. We are confronted with such statements in advertising in all media, and from such statements we learn to strengthen our own arguments. It is often that we hear:

-- "All the kids have one. Why can't I?"

-- "Children can't read today was well as they could 10 years ago."

-- "Children are worse than they've ever been."

-- "This room is always noisy."

-- "Tommy doesn't know how to behave."

-- "All the children do on the playground is fight."

-- "Parents today are too permissive."

Statistic is one of the branches of mathematics that has developed rapidly in recent years, and, in the future, children will be faced with an ever increasing mass of numerical information. To make intelligent decisions, they will need to know something about inquiring into data that is presented to them as fact (How was the data collected? What are the various types of biases that could have been introduced?)

One way to do this is through the study of probability and the use of some of the simpler statistical operations. Such study will lead to the ability of students to use such terms to describe an event or a phenomena as:

-- certain:	"It will rain today because I see rain falling outside."
-- uncertain:	"It is cloudy outside, but I cannot say that it will rain today." (i.e., "I need more information before I am willing to make a prediction.")
-- impossible:	"The temperature is 95°, it is impossible for it to snow here."

III.

There are other things about probability that we must know before we can properly interpret data.

For instance, returning to the example of the two checkers in Section I of this discussion, the probability of a particular event occurring is the ratio of the number of ways the particular event can occur to the number of possible events. We can express the ratio mathematically as indicated on the next page:

$$\text{Probability of a particular event occurring} = \frac{\text{Number of ways the event can occur}}{\text{Total number of possible events}}$$

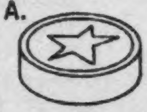
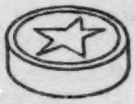
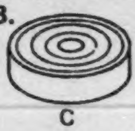
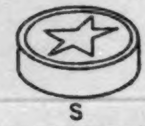
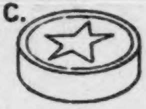
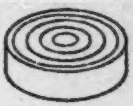
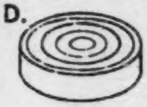
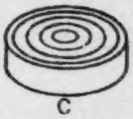
In flipping a checker once, the total number of possible events is 2. Since the probability of obtaining a star is 1/2 and the probability of obtaining a circle is 1/2, what else can we say about the nature of probability from our experiment? The sum of the probabilities of all the possible events is $\frac{1}{2} + \frac{1}{2}$, or $\frac{2}{2}$, or 1. This agrees with our common sense: if we flip a checker, it must result in one of the possible events (since we have barred the possibility of the checker landing on edge).

To illustrate another aspect of this situation, imagine that you have a checker with a star on both sides. What is the probability of obtaining a circle by flipping the checker?

$$\text{Probability of a particular event occurring} = \frac{\text{Number of ways the event can occur}}{\text{Total number of possible events}} = \frac{0}{2} = 0$$

In short, the event cannot happen.

We can also obtain theoretical data on probability by computation. For example, we have said that the probability of obtaining a star by flipping a checker once is $\frac{1}{2}$ (or 1 out of 2). Suppose we flip the checker twice in succession. What are the possible outcomes? Four results are possible, as shown in the table below.

FIRST TOSS	SECOND TOSS	POSSIBLE RESULTS
A.  S	 S	Star on first toss Star on second toss
B.  C	 S	Circle on first toss Star on second toss
C.  S	 C	Star on first toss Circle on second toss
D.  C	 C	Circle on first toss Circle on second toss

The table shows that the probability of getting a star and a circle is greater than that of getting two stars or two circles.

-- What are the chances that flipping one checker two times will turn up a star both times? One out of 4 chances, or $\frac{1}{4}$.

-- What are the chances that the two tosses will turn up a circle both times? One out of four chances, or $\frac{1}{4}$.

-- What are the chances that the two tosses will turn up one star and one circle? Two out of four chances, or $\frac{2}{4}$.

Three different combinations can be obtained by tossing one checker twice. The combinations are:

(1) two stars (Row A);
(2) two circles (Row D);
(3) one star and one circle (Rows B and C).

By performing such experiments, we can see whether our theoretical data hold true. However, all experimental data on probability are based on a "long run," that is, a large number of trials. The greater the number of trials we make (the longer the run), the more likely it is that experimental data will approximate our theoretical data. For example, the familiar expression "fifty-fifty chance" simply means that out of 100 trials (for example, flipping a checker 100 times), the number of stars (or circles) we are likely to flip will be closer to 50 than to 100. However, this is one of the most misunderstood points about probability. It could happen (though it is unlikely) that a checker would register 99 stars consecutively. What would be the probability of obtaining a star on the next toss? Still one out of two. The probability of obtaining a star is one out of two on each flip. But even if we did obtain 99 stars and one circle out of 100 tosses, it is likely that in a run of 1000 trials, we would still come closer to 500 stars and 500 circles.

We have examined the possibilities resulting from tossing a checker twice. Note that tossing one checker twice in a row is the same as tossing two checkers at one time. In both situations the same combinations occur.

PROBABILITY

The objectives for this part of the ETU are:

_____ Given a probability problem, the student will understand that the chance of an event happening equals the total number of successes divided by the total number of tries possible.

Example:

One way of stating this is "1 out of 3" to explain that, when Jane was asked to pick the blue ball out of a sack containing one blue ball and two red balls, her chance of doing so successfully was "1 out of 3". This is stated arithmetically as each chance being 1/3, of an opportunity to correctly do so, or

$$\frac{1}{3} = \frac{\text{the \# of successful events}}{\text{the total possible tries.}}$$

_____ Given a set of events the student will express as a ratio such as four out of six, the probability that the particular event may occur.

_____ Given a set of events the student will express in fractional form the probability that the particular event may occur.

_____ Given a probability situation a student will be able to select from the following words the word that best describes the situation:

likely
more likely
equal chances
certain
uncertain
impossible

_____ Given the probability of a particular event occurring, the student will be able to provide the probability that it will not occur.

Example:

If you roll a die, the probability of getting a 4 is 1/6, or 1 out of 6. The probability of not getting a 4 (i.e. getting anything but 4) is 5/6, or 5 out of 6.

_____ Given an experimental situation in which an event may or may not happen, the student will understand that the probability of a thing happening is always at least zero and never more than 1.

Example:

> The probability (or chance) of getting a "7" on a roll of a single die is 0 since there is no way to roll a "7". This is an impossible event.
>
> The probability of getting one of the numbers 1, 2, 3, 4, 5, or 6 is 1 since $\frac{6}{6} = 1$. This is a certain event.
>
> The probability of getting a "3" on a roll of a single die is $\frac{1}{6}$ (one way out of 6 possibilities). This is an uncertain but possible event.

____ Given a specific event a student will predict that the probability will be certain, uncertain, or impossible.

____ Given words that describe a probability situation (certain, uncertain, impossible), the student will choose events that fit the descriptions.

____ Given a probability statement, the student will determine the possible number of outcomes.

____ Given a probability statement, the student will illustrate all possible outcomes using a variety of displays, e. g., tree diagram, list, graph, chart.

____ Given an illustration of a probability statement, the student will provide probability of a specific event happening.

____ Given an illustration of a probability statement the student will provide probability of all possible outcomes.

____ Given a probability situation in which two things may happen the student will find probability that both will occur together.

____ Given a probability situation, the student will determine the probability of two events happening by listing all possible happenings.

Example:

> Suppose there are 2 chocolates and 1 butterscotch candy in a bag. Suppose also that there are 3 pieces of Double Bubble gum and 2 pieces of Bazooka bubble gum in a box. If a person draws one piece of candy from the bag and one piece of bubble gum from the box the probability of drawing a chocolate and a piece of Double Bubble is:

$$\frac{2}{3} \times \frac{3}{5} = \frac{6}{15}$$

since there is a 2/3 (2 out of 3) chance of drawing a chocolate and a 3/5 (3 out of 5) chance of drawing Double Bubble.

GRAPHING

Opportunities to develop graphs and charts will arise as students collect data that needs to be organized into a form that can be easily communicated. In this way, students will also develop skill in interpreting such graphs and charts as an important part of their reading in social studies, science, current events, etc.

Three forms are presented in this section:

(a) the circle graph, used to illustrate the parts that make up a whole;

(b) the bar graph, used to illustrate comparisons among similar events or objects; and

(c) the line segment graph, used to illustrate the trend (or development) of a single phenomena, event, or object.

The objectives for this part of the ETU are:

_____ For a given set of data (e.g. graph, list, etc.) the student can interpret that data by giving appropriate information.

_____ For a specific situation the student will gather appropriate data by accurate observation and by keeping records, i.e., listing, tallying and categorizing, etc.

_____ For a specific data that has been collected, the student will display the data by listing, diagramming, graphing, etc.

_____ Given data which has been gathered, recorded and displayed in an appropriate form, the student will interpret it by using "mean", "median", "mode", and "range".

_____ Given data which has been gathered, recorded, and displayed in appropriate form, the student will interpret it by naming the appropriate graph.

PROBABILITY - Suggested Activities

101. Have students toss a thumbtack (or any object with only 2 different sides) onto a level hard surface. It can fall pin up (U) or pin down (D). Have the students carry out 50 trials, guess the results first and then record the frequency of each outcome. Discuss the results.

102. To predict the result of flipping a coin, have students flip a coin 10 times and tally each outcome (heads or tails). Encourage students to compare and to combine results with another student. Ask students to predict the outcomes of their next flip based on their previous trials.

103. A box contains six blue marbles and four red marbles. Ask a student the color marble he is most likely to draw. Now blindfold the student and have him choose a marble from the box.

104. Mix up a hat full of marbles and select one marble blindfolded. Now look at it and record its color. Repeat this 100 times and record your results with other members of your group and discuss them.

105. Use three coins to perform these experiments. Toss the three coins fifty times. Record the number of times the coins turn up in each of the four possible ways: 3 heads; 3 tails; 2 heads 1 tail; 1 head 2 tails. Determine the probability of each of the following:
   a. turning up 3 heads
   b. turning up 2 heads and 1 tail
   c. turning up 1 head and 2 tails
   d. turning up 3 tails

106. Toss a die 50 times. List all possible outcomes on a chart and tally the outcomes. Determine the fraction of total trials.

107. Suppose that a biologist injects a vaccine into several rats and then exposes all of them to the same disease. If a rat gets the disease, the biologist records (S) for sick; if not, he records (W) for well. His record is SSWWWW. If another rat is given the vaccine and then exposed to the disease, do you think it will probably stay well? Explain your answer.

108. Roll a pair of dice 50 times. In each roll multiply the two numbers. Guess the product that will appear most frequently. Repeat the experiment. Did the same product occur?

109. Take two boxes. Put 2 red marbles and 3 blue marbles in one. Put 1 white marble and 4 green marbles in the other. Without looking, if you pick one marble from each box, what is the probability that you will choose one red and one green marble? Pick one from each box and record your results.

110. a) If you toss a coin, the probability is 1 out of 2 that the coin will land heads up. What is the probability that it will land tails up?

b) Does the fraction 1/2 represent this probability?

c) Can you write 5 more fractions that represent the same probability as 1/2?

111. Suppose you are blindfolded and a friend places two different pairs of shoes in front of you and tells you to choose one pair. What is the probability that the first two shoes you pick up will be a matched pair?

112. If you were to choose a number at random from the set:

(2,3,4,5,12,13,14,15,22,23,24),

a) what is the probability that the number would be an even number?

b) what is the probability that the number would be an odd number?

c) what is the probability that it would be an even number and a multiple of 5?

d) what is the probability that it would be an odd number and a multiple of 5?

113. Suppose you have 5 red poker chips, 4 blue chips, and 3 white chips in a bag.

a) what is the probability of getting a blue chip on the first draw?

b) what is the probability of getting a white chip on the first draw?

c) what is the probability of not getting a white chip on the first draw?

d) Suppose you got a red chip on the first draw. What is the probability of getting another red chip on the next draw?

e) If you know that the probability of getting a blue chip is zero, what does this tell you about the colors of the chips in the bag?

114. Toss a coin 25 times and keep a record of the number of times heads appears and the number of times tails appears. From your experiment what do you think is the probability of getting heads?

Now toss the coin 50 times and record the results the same way. How do the two charts compare? Do you think there is any change in the probability of the number of times heads will appear?

115. Many games such as Monopoly or parcheesi use two dice with a certain number of dots on each face of each die. Usually the dots number from 1 to 6 on each face.

Toss a die 60 times and record the number of times each of the numerals, 1, 2, 3, 4, 5, or 6 appears.

Can you think of a way to record the results of this kind of experiment using two dice at a time? Try it!

116. Make a set of cards with the letters A, B, C, D, E.

$\boxed{A}$ $\boxed{B}$ $\boxed{C}$ $\boxed{D}$ $\boxed{E}$

Make 14 "A" cards, 8 "B" cards, 6 "C" cards, 6 "D" cards, and 2 "E" cards.

If you shuffle the cards and draw one card, what is the probability of getting an "A" card?

What is the probability of getting an "E" card?

Which cards would have equal chances?

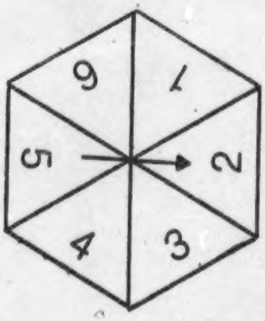
Make a simple chart to record this experiment. Make a guess as to the letter of the card you think you will get. Write it down. Draw a card and write down the letter of the card you actually got. See how many times you win.

117. You have probably played games that have a spinner like the one below. If you do not have one, make one like it with card board and a brass, round head paper fastener. Use stiff flat cardboard and make sure the spinner turns freely.

If you spin the spinner just one time, what is the probability of landing on 6?

What is the probability of landing on 3?

Spin the spinner 20 times and record the results.



Numeral	1	2	3	4	5	6
Occurs						

117. Which numeral occurred the greatest number of times? ___________

Which numeral occurred the least number of times? __________

According to your experiment, which numeral seems most likely to occur? ____________

Which one seems least likely to occur? __________

Try this experiment two more times and compare the three records you now have. Have you changed your opinion? _________

118. There are many practical uses of probability in science, advertising, insurance, TV ratings, and test writing. See whether you can find information about some practical use of probability and write a report on it, or describe an experiment or project that demonstrates it.

119. Ask children to choose a partner. Each player has 12 counters. Play for these in a game with 2 dice. Whenever 11 is thrown (by either), A gives a counter to B. Whenever 9 is thrown (by either), B gives a counter to A. The player who first wins all the counters wins the game. Which player (A or B) is most likely to win, and why?

120. Ask students to take a die. Throw it until you get a 6. How many throws did you need? Record this. Run a number of trials recording each time. Plot a bar graph of the frequencies of 1, 2, 3, etc. throws. What was the most common number of throws? What was the average number of throws?

121. Have students shuffle a pack of playing cards. Deal out 4. How many are clubs? Record this. Replace the cards, shuffle and try again. Carry out a number of trials. Make a bar graph with the frequencies of no clubs, 1 club, 2 clubs, 3 clubs, or 4 clubs.

122. Have students shuffle a pack of cards. Deal out 4. How many of the 4 are black? Record this. Replace the cards. Run a number of trials, Plot a bar graph showing how many times you had no blacks, 1, 2, 3, or 4 blacks.

123. Take two boxes. Put 3 red and 2 blue marbles in one and 2 yellow and 1 green in the other. If you pick one marble from each box without looking, what are all of the possible outcomes you could get?

124. Give students some dominoes. Have them remove all the dominoes with one or two blanks. 21 should be left. Shuffle them face down on the table. Draw one at random. Count the total number of pips on it. Replace it and reshuffle. Run a number of trials and plot a bar graph showing the frequencies of different totals of pips.

125. Have students take a book. Count the number of letters in each word in one paragraph of the book. Plot a bar graph showing the number of words with one, two, three... etc. letters. Take a very difficult book. Do the same. Compare the two graphs.

GRAPHING - Suggested Activities

401. Role two die from a cup 100 times. Record the sum of the two numbers on a tally sheet. Make a bar graph showing which sum you got the most times. The least. Explain your results. The possible reasons for your results.

402. Survey classmates to determine the birthdays of each member. What are the probabilities of two students having a birthday on the same day of the same month. List the birthdays and illustrate them on a graph.

403. Survey students to determine how they spend the hours of the day. Have students draw a circle graph listing acitivities.

404. Find the mean, median, mode, and range of daily temperatures during the week. List them on a graph.

405. Have several students run the 25-yard dash. Clock the time for each student and record the data on a graph. Find the mean, median, mode, and range.

406. Have your students use the newspaper to list the number of 30-minute TV programs in each of the following categories: sports, news, education programs, quiz or game shows, comedy. Illustrate the listings on a graph. What conclusions can be drawn from the listings?

407. Take a poll of the kinds of pets students have in the class. Graph the results.

408. Have students line up at the basketball net and ask them to throw the ball ten times. Repeat the activity to find the average number of successes. Repeat the activity many times, recording the results and graphing them. Have students interpret results.

409. Have students make a circle graph on ways they spend their allowance during a given week.

410. Using the attendance record, have students graph the frequencies of absenteeism on a chart. Compute the mean, median, mode, and range of the results.

411. Draw a circle graph illustrating your daily diet.

412. Conduct a survey of your classmates favorite sport. Make a circle graph to illustrate this data.

413. Imagine you have the following ingredients: vanilla ice cream, 1 cherry, nuts and chocolate syrup. Make a tree diagram listing all possible combinations.

414. Use the world almanac to show the birth and death rate for five states during a given year. Construct a bar graph to illustrate this data. What conclusions may be drawn from the graph?

415. Draw a bar graph to illustrate the ten top selling records of the year. (Data may be obtained from the world almanac.)

Probability

Probability is an exciting branch of mathematics in which mathematicians use measures of chance to answer questions for science and industry. On this and the next three pages, you will learn something about probability and how to use measures of chance to answer certain kinds of questions.

1. Suppose you tossed a coin in the air. Is it possible that the coin will land "heads"? _________

Is it also possible that the coin will land "tails"? _______ Then the coin can land in one of two possible ways.

One of the two possible outcomes when you toss a coin is heads. We say that the probability of getting heads on one toss is 1 out of 2, or 1/2.

The other one of the two possible outcomes when you toss a coin is tails. Can we say that the probability of getting tails in one toss is also 1 out of 2, or 1/2? ________

2. Toss a coin 50 times and see how many heads and how many tails you get. Use the chart in the next column to record the results of the experiment. Put a mark in the HEADS column each time the coin lands heads. Put a mark in the TAILS column each time the coin lands tails.

3. What is the total number of marks for heads? ______ for tails? _________
The more times you toss a coin, the nearer you are likely to come to the probability 1/2. Toss the coin 50 more times. Then combine the results of the first 50 tosses. What is the total number of marks for heads? ______ What is the total number of marks for tails? _______

TOSS	HEADS	TAILS
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
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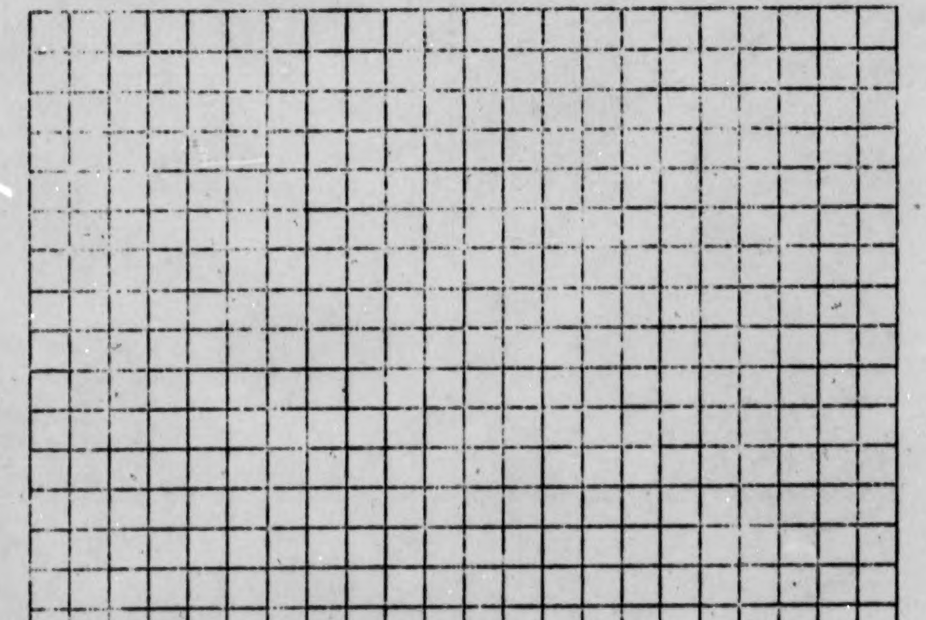
48		
49		
50		

Probability

One of the most interesting applications of probability is a random walk The work random means "unguided" or "left to chance." A good example of a random walk is the movement of molecules of air in a room. They move about in an unguided, or random, way. In the experiment below, the pattern that you make by tossing a coin will be a very simple one. The patterns made by the molecules of air are much more complex.

On the grid below, you are to record the results of tossing a single coin. Toss the coin once. If it lands heads, start at the dot on the paper and draw a line segment one space to the right. If the coin lands tails, start at the dot and draw a line segment one space up toward the top of the paper. Keep tossing the coin and drawing line segments either to the right or up from your last move. If the coin lands heads several times in a row, keep drawing line segments to the right. If the coin lands tails several times in a row, keep drawing line segments up. Toss the coin until the last line segment goes of the grid. See what pattern develops.

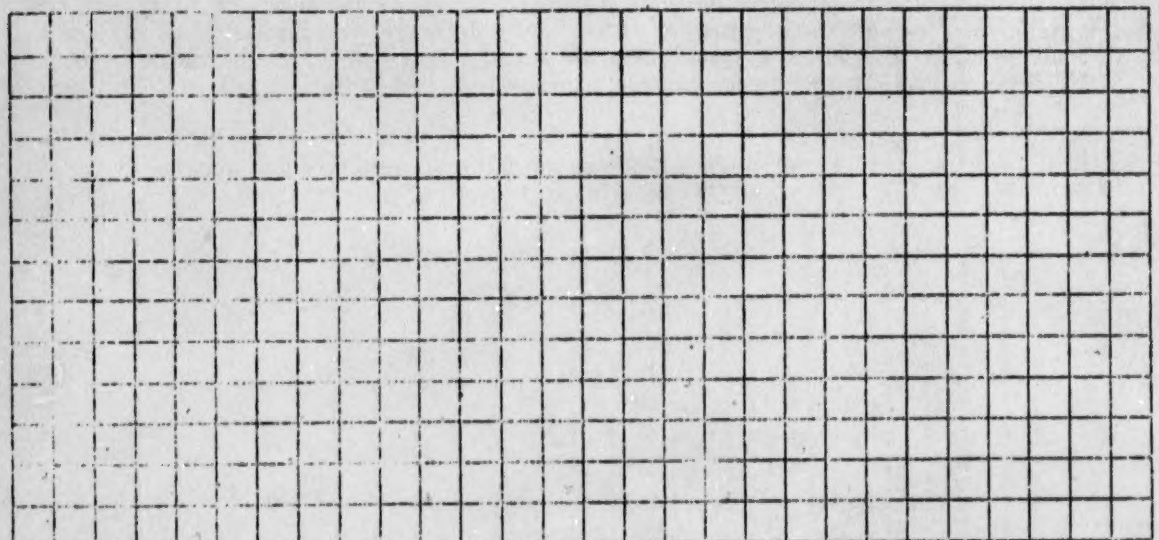
Repeat the experiment and draw the line segments, with a colored pencil or a crayon. Is the pattern different the second time?



Probability

For this random walk you will need a die (one of a pair of dice). On the grid below, start your movements from the dot in the center of the paper. Toss the die and if "1" comes up, draw a line segment one space to the right. If "2" or "4" comes up draw a line segment one space to the left. If "3" or "5" comes up, draw a line segment one space up. If "6" comes up, draw a line segment one space down. Toss the die fifty times and see what pattern develops.

Repeat the experiment and see if an entirely different pattern develops. Then repeat the experiment again. Each time the pattern should be different.



L-23

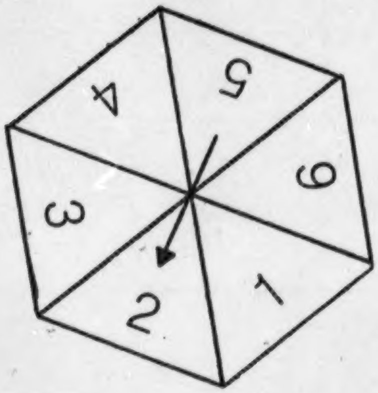
POSSIBLE OUTCOMES

1. How many possible outcomes are there when you toss a penny? ____________

2. How many possible outcomes are there when you toss a penny and a nickel? ____________

3. How many possible outcomes are there when you spin the pointer on the spinner below? ____________

The spinner shown was spun 30 times. The results are recorded in the table below. Complete the table by doing exercies 4, 5, 6, 7, 8, 9, and 10. (Blank and incomplete spaces in table.)



OUTCOME	TALLY	NUMBER FOR EACH OUTCOME	FRACTION OF TOTAL TRIALS
1	𝍸	5	$\frac{5}{30}$
2	𝍸 //	7	4. $\frac{\quad}{30}$
3	𝍸 /	5.	6. $\frac{\quad}{30}$
4	///	7.	8. $\frac{\quad}{30}$
5	𝍸 ////	9.	10. $\frac{\quad}{30}$

DIE-TOSSING EXPERIMENT

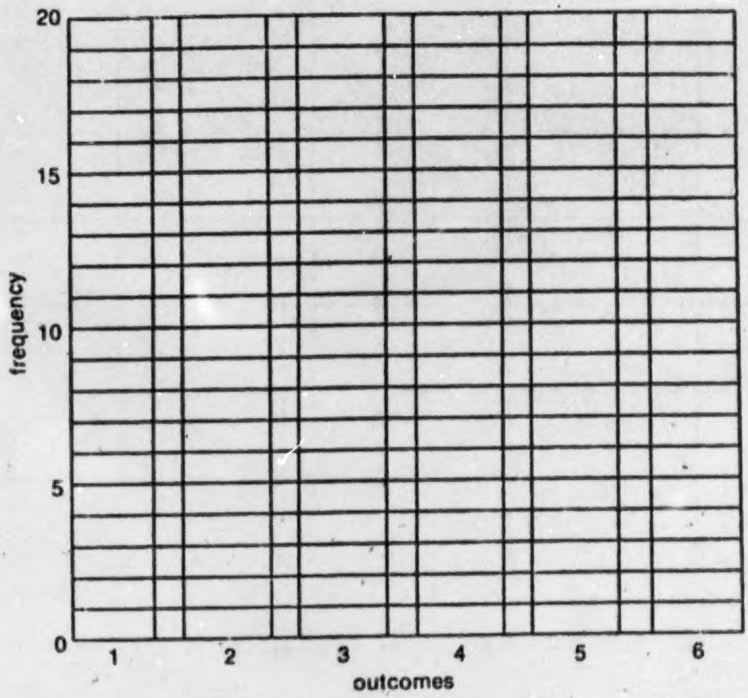
1. In this experiment, a die is tossed. One of two dice is called a die. When a die is tossed, the possible outcomes are 1, 2, 3, 4, 5, and 6. The number of times an outcome occurs in an experiment is called the frequency.

   How often do you think the 5 will turn up? ____________

2. Toss a die 30 times. Tally the outcomes in the table below as you toss the die. Then complete the table.

Outcome	Tally	Frequency (number)	Fraction of total trials
1			$\frac{}{30}$
2			
3			
4			
5			
6			
	Total		$\frac{}{30}$

3. Using your results from the table on the previous page, make a bar graph. Draw each bar to show the frequency for an outcome.



4. Combine your results with those of another student. Complete the table below.

Outcome	Your frequency	Partner's frequency	Combined frequency	Fraction of total trials
1				$\frac{}{60}$
2				
3				
4				
5				
6				
TOTAL				$\frac{}{60}$

5. How many outcomes were possible in the die-tossing experiment? __________

6. Was the fraction of total trials for each outcome about $\frac{1}{6}$? ______________

When tossing a fair die, each of the 6 numbers has the same chance of appearing. In this case, we say that the 6 numbers are equally likely.

7. What might be the reason if 5 came up nine out of ten times?

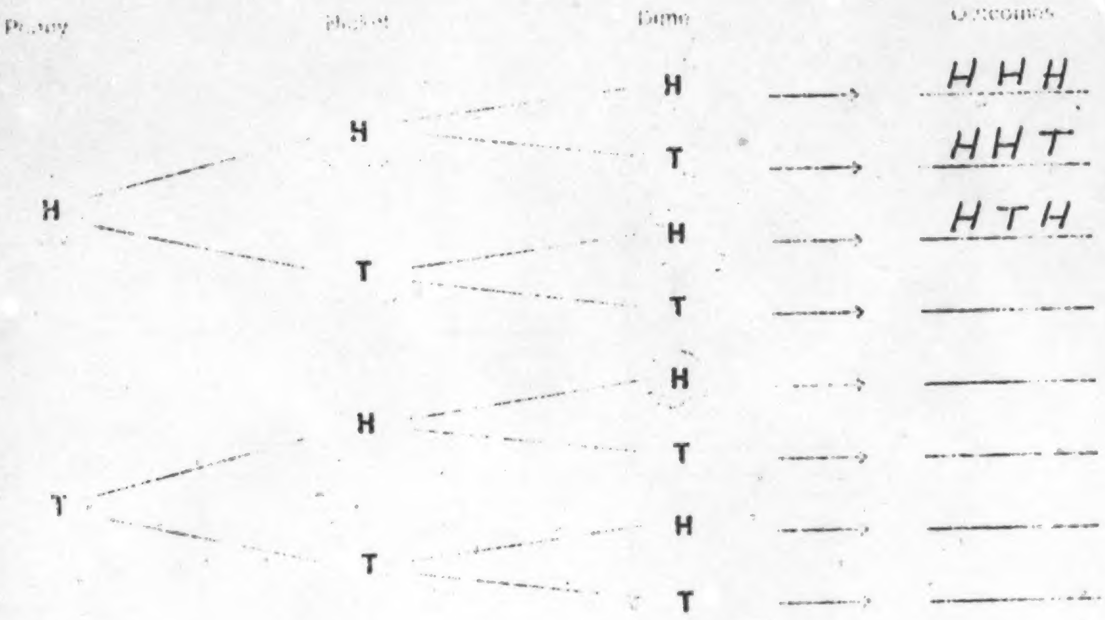
8. Are the fractions for total trials in the table above closer to $\frac{1}{6}$ than those in the table on the preceeding page?

The more trials you perform with a fair die, the closer to $\frac{1}{6}$ you would expect the fraction to be.

MEASURES OF CHANCE

1. Before you take a chance, you should know what the risk is. Three coins -- a penny, a nickel, and a dime -- are tossed.

   The tree diagram below shows all the possible outcomes. Use H and T to show the results. Some have been done for you.



2. How many different outcomes for three coins are possible? ________

3. What fraction of these possible outcomes give 3 heads (H,H,H)? _______

4. What fraction of these possible outcomes is each different outcome? ___

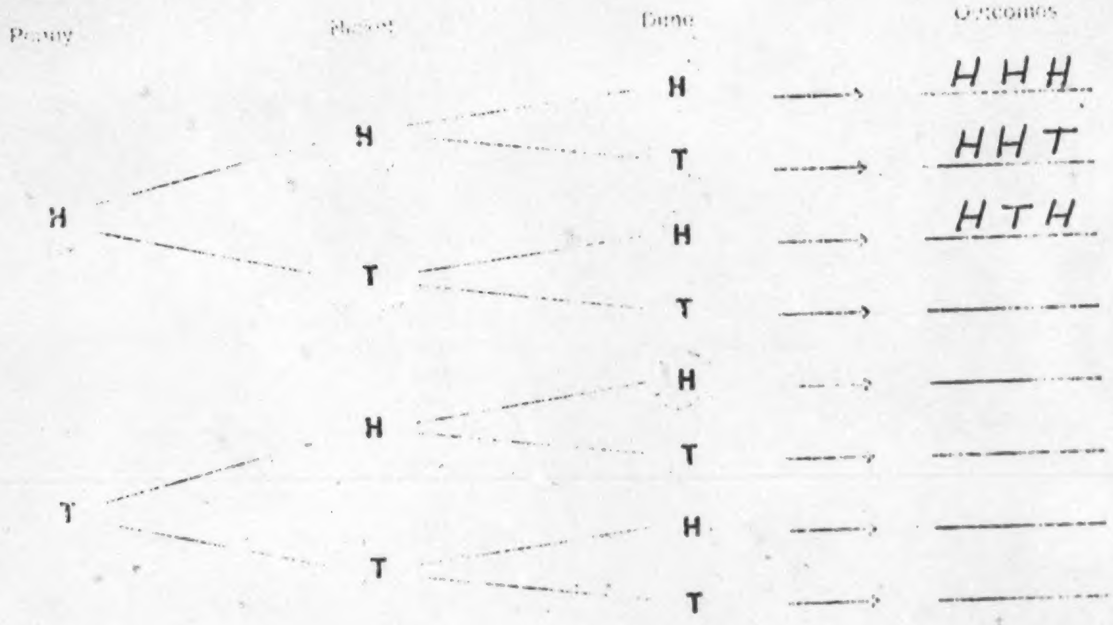
5. How many times would you expect to get H H H? _______

6. How many times would you expect to get H H T? _______

MEASURES OF CHANCE

1. Before you take a chance, you should know what the risk is. Three coins -- a penny, a nickel, and a dime -- are tossed.

   The tree diagram below shows all the possible outcomes. Use H and T to show the results. Some have been done for you.



2. How many different outcomes for three coins are possible? __________
3. What fraction of these possible outcomes give 3 heads (H,H,H)? ________
4. What fraction of these possible outcomes is each different outcome? ___
5. How many times would you expect to get H H H? ________
6. How many times would you expect to get H H T? ________

THREE COIN EXPERIMENT

1. Find out what outcomes you actually get when you toss 3 coins 32 times. Record your results in the table below.

Outcome			Tally	Frequency	Fraction of total trials	Expected fraction of total trials
Penny	Nickel	Dime				
H	H	H			$\frac{\quad}{32}$	$\frac{1}{8} = \frac{\quad}{32}$
H	H	T			$\frac{\quad}{32}$	$\frac{1}{8} = \frac{\quad}{32}$
H	T	H				$\frac{1}{8} = \frac{\quad}{32}$
H	T	T				$\frac{1}{8} = \frac{\quad}{32}$
T	H	H				$\frac{1}{8} = \frac{\quad}{32}$
T	H	T				$\frac{1}{8} = \frac{\quad}{32}$
T	T	H				$\frac{1}{8} = \frac{\quad}{32}$
T	T	T				$\frac{1}{8} = \frac{\quad}{32}$
			TOTAL	32		

2. Which outcomes resulted in a fraction that is equal to $\frac{1}{8}$ or $\frac{4}{32}$?

3. The fraction of total trials for each outcome in an experiment is the experimental probability for that outcome. The probability of an outcome is a prediction of how often the outcome will occur. To find the probability of an outcome from an experiment, use the fraction

$$\frac{\text{number of times the outcome occurred}}{\text{number of trials}}$$

Circle the fractions of total trials for each of the outcomes that are $\frac{3}{32}$ or $\frac{5}{32}$.

PREDICTING COIN TOSSES

1. To find the probability of an outcome, you first record all the possible outcomes. Then complete the table below for coin tossing.

Number	Possible outcomes for coins tossed	Number of possible outcomes
1 coin	Ⓗ Ⓣ	2
2 coins	Ⓗ Ⓗ, Ⓗ Ⓣ, Ⓣ Ⓗ, Ⓣ Ⓣ,	
3 coins	Ⓗ Ⓗ Ⓗ, Ⓗ Ⓗ Ⓣ, Ⓗ Ⓣ Ⓗ, Ⓗ Ⓣ Ⓣ Ⓣ Ⓗ Ⓗ, Ⓣ Ⓗ Ⓣ, Ⓣ Ⓣ Ⓗ, Ⓣ Ⓣ Ⓣ	8

2. Sometimes we assume that the outcomes in an experiment are equally likely. On a fair coin, heads and tails are equally likely. There is 1 way to get heads. There are 2 possible outcomes. The probability for heads is $\frac{1}{2}$ for a fair coin.

   What is the probability of tails for a fair coin? $\boxed{\frac{\quad}{\quad}}$

3. If a fair coin is tossed 20 times, about how many times do you expect to get heads? ______

4. If outcomes are equally likely, the probability of each outcome is

$$\frac{1}{\text{number of possible outcomes}}$$

   When tossing 2 coins, there are 4 different outcomes. One outcome is H,H. What is the probability of getting 2 heads when tossing 2 coins?

$$\boxed{\frac{\quad}{\quad}}$$

5. If 2 coins are tossed 20 times, about how many times do you expect to get 2 tails?

$\boxed{\frac{\quad}{\quad}}$

6. When tossing 3 coins, there are 8 different outcomes. What is the probability of getting each outcome?

$\boxed{\frac{\quad}{\quad}}$

7. If 3 coins are tossed 32 times, about how many times do you expect to get 3 heads? ____________

8. The table below shows the probabilities for equally likely outcomes. Complete this table.

Number of possible outcomes	Probability for each outcome
2	$\frac{1}{2}$
3	$\frac{1}{3}$
4	
	$\frac{1}{5}$
9	

9. The table below shows the probabilities for coin tosses. Complete this table.

Number of fair coins	Number of possible outcomes	Probability for each outcome	Predicted number of times each outcome occurs in 64 trial
1	2	$\frac{1}{2}$	32
2		$\frac{1}{4}$	
3			
4	16		

10. If you toss coins 64 times, will you always get the number of outcomes predicted in the table above? ____________

DICE TOSS

1. If you toss a fair die, about how many times would you predict a 2 would be tossed in 60 trials? ________

2. A die is tossed 60 times. The results are shown in the table below. Complete the table by doing exercies 2, 3, 4, 5, 6, 7, 8, and 9 (blank and incomplete spaces in table).

Outcome	Frequency	Fraction of total trials
1	14	2. $\frac{}{60}$
2	9	3.
3	4.	$\frac{10}{60}$
4	5.	$\frac{12}{60}$
5	6.	$\frac{6}{60}$
6	9	7.
TOTAL	8.	9.

DRAWING CARDS FROM A HAT

Place a King of spades, clubs, diamonds, and hearts in hat and mix them up.

1. How many cards are in the hat? __________

2. How many Kings are in the hat? __________

Draw a card, look at it, and replace it in the hat.

3. If you make 10 draws, what fraction of draws will be Kings? $\boxed{\frac{\quad}{\quad}}$

4. Since all of the cards in the hat are Kings, what is the probability of drawing a King? ____________

5. If you make 10 draws from the hat, what fraction of draws will be Queens? $\boxed{\frac{\quad}{\quad}}$

6. What is the probability of drawing a Queen in this experiment? _____________

7. Circle the outcome that is certain. Queen King

8. Circle the outcome that is impossible. King Queen

COIN TOSSING

When a coin is tossed, there are two possible ways it can land.

One outcome is:

Heads (H)

The other outcome is:

Tails (T)

1. Toss a coin 20 times. Tally each outcome in the table below as you toss the coin. Complete the table.

Outcome	Tally	Number for each outcome	Fraction of total trials
H			$\frac{\quad}{20}$
T			$\frac{\quad}{20}$
		Total	$\frac{\quad}{20}$

2. Combine your results from the table above with those of another student. Fill in the table below.

Outcome	Your number for each outcome	Partner's number for each outcome	Total number for each outcome	Fraction of total trials
H				$\frac{\quad}{40}$
T				$\frac{\quad}{40}$
Total				$\frac{\quad}{40}$

3. How many different outcomes were possible in this experiment? __________.

We say that the chances that a "fair" coin will land heads is about $\frac{1}{2}$.

4. Was the fraction of the total trials for each outcome in this experiment about $\frac{1}{2}$ (about $\frac{20}{40}$)? __________

5. If a coin landed heads 99 times out of 100, would you think it was fair? __________

6. Jim performed three experiments by tossing a coin. In one experiment, he tossed the coin 20 times. It landed heads 8 times. How many times did it land tails? __________

7. Complete the table below:

Number of tosses	Number of heads	Number of tails
20	8	
15	4	
100	50	

8. Use the results in the table below to find the fraction of total trials for each outcome.

Fraction of heads	Fraction of tails	Sum of the 2 fractions
$\frac{8}{20}$		
$\frac{4}{15}$		
$\frac{50}{100}$		

9. If you reduce the sums of the 2 fractions, what is the sum in each case? _____

COIN TOSSING

10. Two coins, a penny and a nickel were tossed. The outcomes are the different ways the two coins may fall. With a penny and a nickel, there are four possible outcomes.

Toss two coins 20 times. Record your results in the table below.

PENNY	NICKEL	OUTCOMES
H	H	→ (H,H)
H	T	→ (H,T)
T	H	→ (T,H)
T	T	→ (T,T)

Outcome		Tally	Number for each outcome	Fraction of total trials
Penny	Nickel			
H	H			$\frac{\quad}{20}$
H	T			$\frac{\quad}{20}$
T	H			$\frac{\quad}{20}$
T	T			$\frac{\quad}{20}$
		TOTAL		$\frac{\quad}{20}$

11. Your experiment shows that your chance of tossing two heads is about ________ out of 20.

12. Your chance of tossing one head and one tail is $\frac{\square}{\square}$

13. Your chance of tossing two tails is $\frac{\square}{\square}$

WHAT IS CERTAIN?

When events occur or are going to occur, we have different ways of talking about them. When we are sure something will happen, we say it is a certain event. For example, if you spin a spinner that is all red, getting red is a certain event. Its probability is 1. The probability of getting blue on the same spinner is 0, which we call an impossible event.

On a spinner with more than one color, the probability of getting one of the colors is greater than 0, but less than 1. We say that these are uncertain events.

Consider flipping a coin. There are equal chances of getting a head or a tail. It is likely that you will get one of them, but one is not more likely than the other.

Exercise: Using the words: likely, more likely, equal chances, certain, uncertain, and impossible, identify the following events:

1. Toss one coin. Getting a head. ________
2. Getting a head vs. getting a tail. ________
3. Spin three color spinner. Getting a particular color. ________
4. Spin one color spinner. Getting that color. ________
5. Spin three color spinner. Getting a color not on the spinner. ________
6. Toss one die. Getting a 1, 2, 3, 4, 5, or 6. ________
7. Toss one die. Getting a 7. ________
8. Toss two dice. Getting a sum of 13. ________
9. It is raining. You walk outside without an umbrella. You will get wet. ________
10. You are launching a space ship. It will take off. ________

Complete this table.

TABLE 2

Fill in the missing information.

Experiment	Events considered success	P(success)	Events considered failure	P(failure)	P(success) P(failure)
Toss a die	3	1/6	1, 2, 4, 5, or 6	5/6	1
Toss a coin	H				
Toss 2 coins	HH, TH	1/2			
Player at bat	Gets a hit				
Launch a space ship					

From your chart, answer the following:

1. P(success) + P(failure) = ____________.
2. Is this always true? ________
3. If the probability of getting a 5 when you roll a single die one time, is 1/6, what is the probability of not getting a 5? ____________
4. If the probability of rain is 40% tomorrow, what are the chances that it will not rain? _________
5. If you have a 3 out of 4 chances of spinning "red" on a spinner, what are your chances of not spinning "red"?

SUCCESS or FAILURE

Sometimes we consider certain outcomes of an experiment to be "successes" and the other outcomes to be "failures". This does not mean that they are good or bad but just a way to name the different outcomes.

For example, suppose you call getting a head (H) when you toss one coin, a success. Then getting a tail (T) would be called a failure. Notice that the probability of getting a head is 1/2 and the probability of getting a tail is 1 - 1/2 = 1/2. The total of the probabilities is 1. Complete Table 1, by filling in the missing information.

Table 1.

Experiment	Outcomes	Successes	Failures
Toss a die	1,2,3,4,5,or 6	2 or 6	1,3,4or5
Player at bat	gets a hit, does not get a hit	gets a hit	
Toss a coin	H, T	H	
Toss two coins	HH,HT,TH,TT	TT,HH	
Launch a spaceship	takes off,does not take off	takes off	

How did you figure out the "failures"? ________________________

** Notice that: OUTCOMES - SUCCESSES = FAILURES

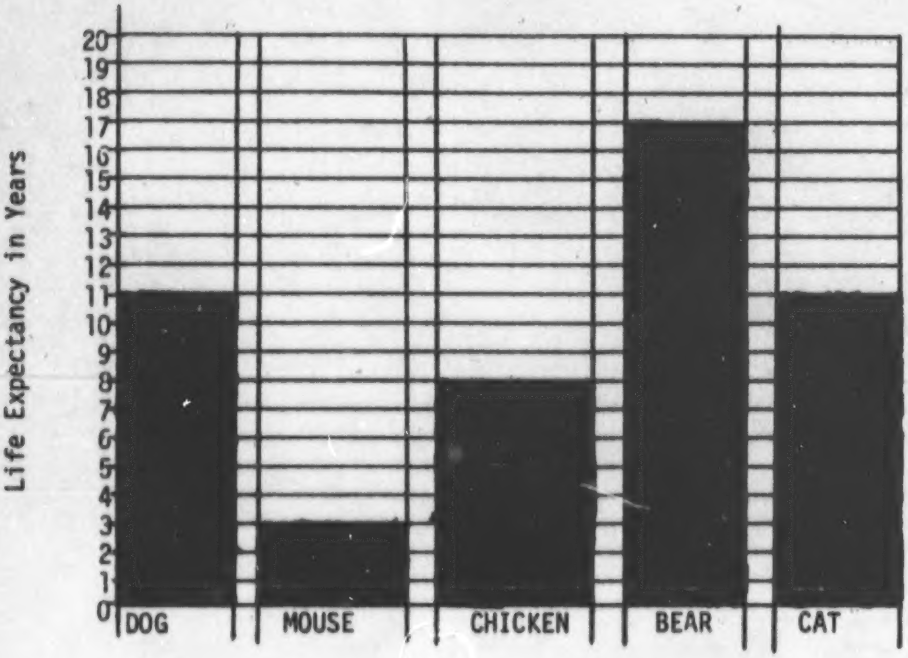
Another way to say this is that the "failures" are those outcomes that are not considered "successes".

Notice also that the "successes" are the outcomes not considered "failures". When you toss a single coin one time, not getting a head means getting a tail and vice versa.

Now let's look at the probabilities.

BAR GRAPHS

Life Expectancy of Animals



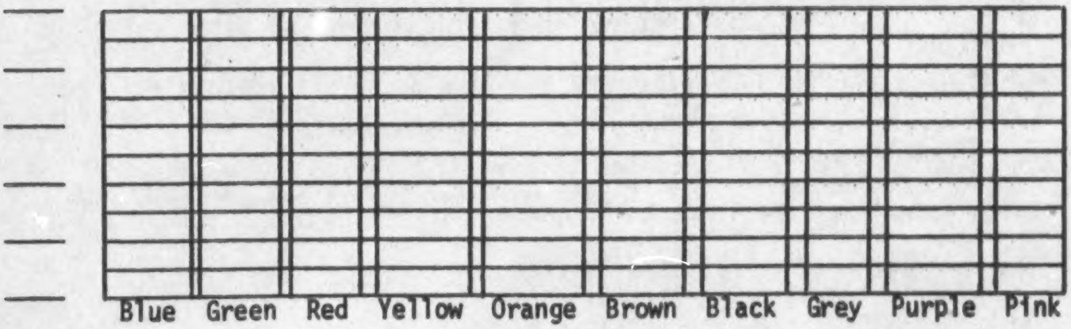
1. Which animal has the longest life expectancy? ________________
2. How many years is it expected to live? ___________
3. Which animal has the shortest life expectancy? ____________
4. How many years is it expected to live? __________

CHOOSE YOUR FAVORITE COLOR

Cut up pieces of small colored squares. Place them in a box and have students choose their favorite color. Record the number of students in your class who selected each color on the table below.

Color	Blue	Green	Red	Yellow	Orange	Brown	Black	Grey	Purple	Pink
Number of students										

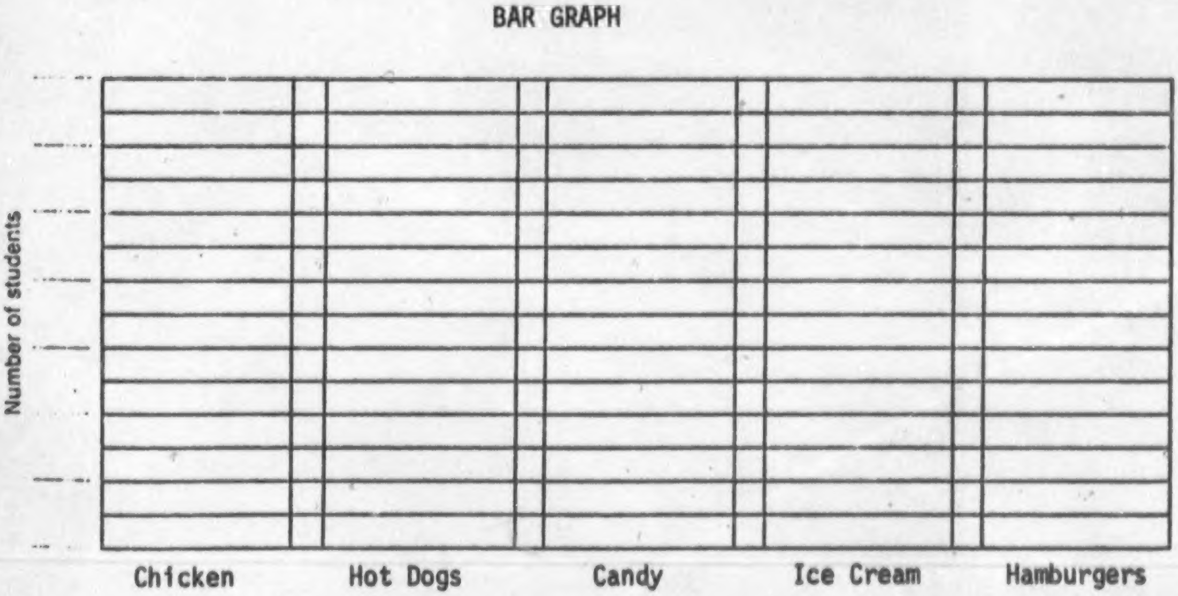
Make a graph of the number of students who selected each color. Choose a number scale for the number of students and fill in the graph.



CHOOSE YOUR FAVORITE FOOD

Make a bar graph of your class's favorite food chosen from the list below. Your bar graph should show the number of students that chose each food.

Food	Chicken	Hot Dogs	Candy	Ice Cream	Hamburgers
Number of students					



5. On how many days did the temperature exceed 80°?

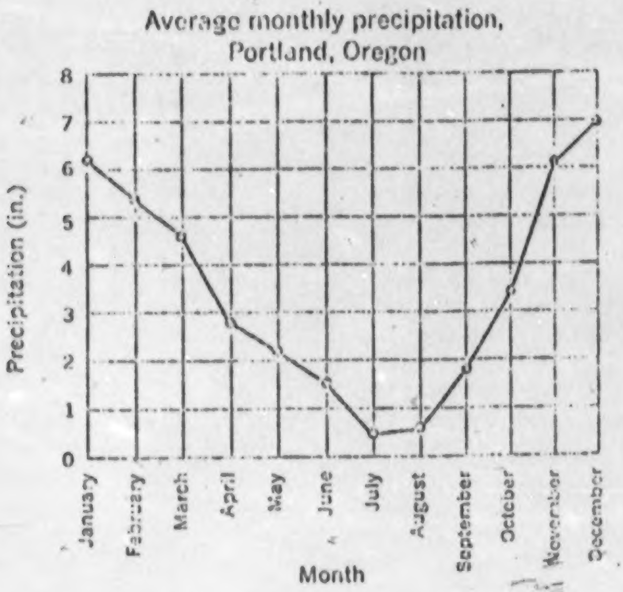
6. On which days did the temperature fall below 60°?

7. What is the difference between the highest and the lowest temperature of the week?

8. What is the range of the temperatures for the week?

LINE-SEGMENT GRAPH

Graphs like the following one are called line-segment graphs. This graph was constructed by plotting points corresponding to the month and the rainfall for that month. Then, successive points were joined by drawing line segments.



Discussion Exercises

For Discussion Exercises 1 through 4, refer to the percipitation graph.

1. Give the approximate average rainfall for each month.

2. In which months is the average rainfall

   (a) less than 2 in.?   (b) more than 5 in.?

3. Do you think the points on the segments between the months have any meaning?

4. Does the graph give you any idea of the rainfall on a particular day of the month? Explain your answer.

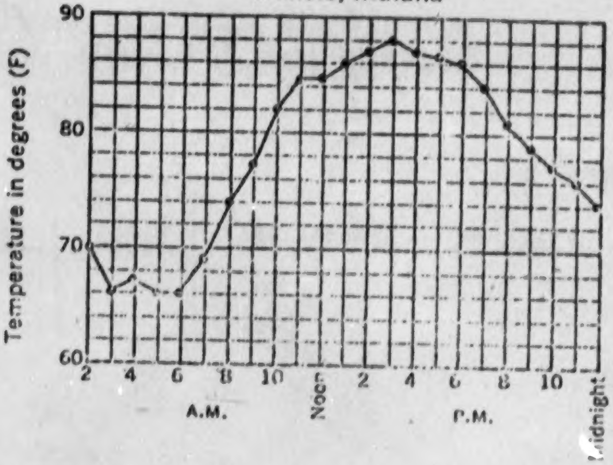
LINE-SEGMENT GRAPHS- 2

5. (a) What was the highest temperature on August 25? When did the highest temperature occur?

   (b) What was the lowest temperature? When did the lowest temperature occur?

   (c) How much did the temperature rise between 6:00 A.M. and noon?

   (d) How many degrees did the temperature drop between 3:00 P.M. and midnight?


Hourly temperatures, August 25, 1966, Muncie, Indiana

6. For a decade, the average daily high temperature for the month of July is given in the table. Construct a line-segment graph to illustrate this data.

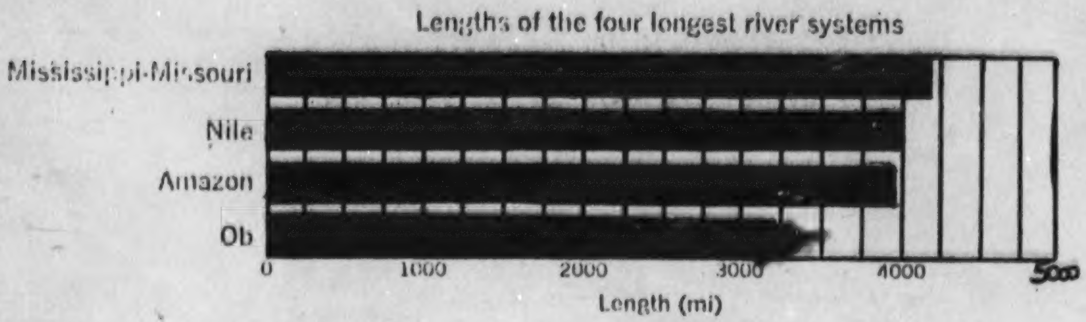
Year	Average daily high (degrees, F)	Year	Average daily high (degrees, F)
1957	84.0	1962	81.6
1958	77.4	1963	84.9
1959	83.8	1964	85.3
1960	84.8	1965	82.3
1961	83.8	1966	90.5

7. A traffic survey to determine the number of cars passing through a street intersection found the information in the table. Construct a line-segment graph to illustrate this data.

Time interval	Number of cars
6-7:00 A.M.	48
7-8:00 A.M.	244
8-9:00 A.M.	360
9-10:00 A.M.	121
10-11:00 A.M.	72
11:00 A.M. - noon	112
12-1:00 P.M.	213
1-2:00 P.M.	147
2-3:00 P.M.	139
3-4:00 P.M.	354
4-5:00 P.M.	402
5-6:00 P.M.	389

BAR GRAPH

The following horizontal bar graph compares the lengths of the four longest river systems in the world. Study the graph and note how it is constructed.



Discussion Exercies

The discussion exercies will help you to recognize and understand some of the features of horizontal bar graphs. Use the preceding graph to answer Discussion Exercies 1 through 6.

1. a) What is the title (or name) of the graph?
   b) Does the title accurately describe what the graph shows?

2. a) On the graph, 1 square represent ___?___ miles?
   b) If a scale of 1 square for each 100 miles had been used, would the bars on the graph be longer or shorter?

3. Note that all the bars are the same width and all the bars are spaced equally apart. What does this feature contribute to the graph?

4. Why is it helpful to have the rivers listed in order of their lengths?

5. a) Give the approximate length of each river shown on the graph.
   b) How accurate are your answers to Part a? Are they accurate to the nearest mile? Are they accurate to the nearest 100 miles? Explain your answers.

6. a) Would it be useful to round the lengths of each river before drawing the graph?
   b) Would you round the lengths of the rivers to the nearest 1000 miles before drawing the graph? Explain your answer.

7. The vertical bar graph shows public school enrollment in the United States.

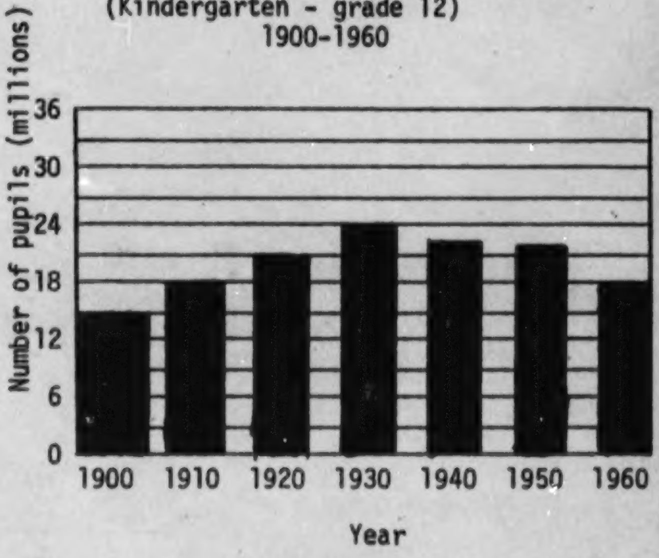
   a) Give the approximate school enrollment for each year shown on the graph.

   b) How many more pupils were enrolled in 1960 than in 1900?

   c) In which ten year period did school enrollment grow most most rapidly? What was the increase in enrollment during this period?

   d) During which years did school enrollment decrease?

U.S. Public School Enrollment
(Kindergarten - grade 12)
1900-1960



8. Construct a bar graph using the heights of the five mountains. Round the height of each mountain to the nearest 1000 feet before drawing the graph.

Mountain	Height (ft)
Everest	29,141
McKinley	20,300
Popocatepetl	17,883
Matterhorn	14,705
Pikes Peak	14,110

9. Construct a vertical bar graph giving the approximate population of the United States by decades from 1900 to 1960.

Year	Approximate population (millions)
1900	76
1910	92
1920	106
1930	123
1940	132
1950	151
1960	180

10. Using the graph you constructed in Exercise 9, give an estimate of the population of United States in 1970. Use the graph to estimate the population in the year 2000.

SOME MEASURES OF CENTRAL TENDENCY

The Mean, Median and Mode

Jerry made a list of the ages of his classmates' fathers. His list comprised 25 numbers:

42,40,36,38,51,39,38,39,55,40,44,47,38,
50,34,38,43,49,42,37,41,48,52,35,45

In order to analyze the set of numbers, Jerry arranged them in order, from largest to smallest.

Rank	Age
1	55
2	52
3	51
4	50
5	49
6	48
7	47
8	45
9	44
10	43
11	42
12	42
13	41
14	40
15	40
16	39
17	39
18	38
19	38
20	38
21	38
22	37
23	36
24	35
25	34
Total	1041

The range of the set of numbers is the difference between the largest and smallest numbers in the set.

55 — 34 = 21

The median of a set of numbers is the middle number of the set.

41 is the median.

The mode of a set of numbers is the most frequently occurring number in the set, if there is such a number.

38 is the mode.

The arithmetic average or mean is the sum of all the numbers divided by the number of numbers in the set.

$$\frac{1041}{25} = 41.64$$

If the number of ages were an even number, then the median would be found by finding the average of the two "middle numbers." Notice that, in this case, the median and the mean are very close to each other; however, this is not always the case.

The mean, median, and mode are called measures of central tendency.

1. Find the range, mean, median, and mode of the list of numbers.

91,85,84,92,86,84,85,86,79,94
76,90,91,77,64,87,89,91,87,88

2. The score sheet shows the scores of a bowling team for three games.

Team Score Sheet				
Name	Game 1	Game 2	Game 3	Three-game total
Bob	136	148	128	
Chuck	158	139	145	
Lew	162	170	166	
Ike	151	144	181	
Don	169	208	195	
Team Total				

a) Find the three game total for each person on the team.
b) Find the team total for each game.
c) Find the average score of each person on the team for the three games. (Round your answers to the nearest whole number.)
d) What was the average score bowled by the team for each of the three games? (Round you answers to the nearest whole number.)

3. The scores for a mathematics test given to a class are listed below:

82,88,72,94,90,69,74,81,89,85,72,92
80,66,75,85,96,92,83,87,84,82,77,78

a) What is the range of the scores?
b) What is the median score?
c) What is the mean score?

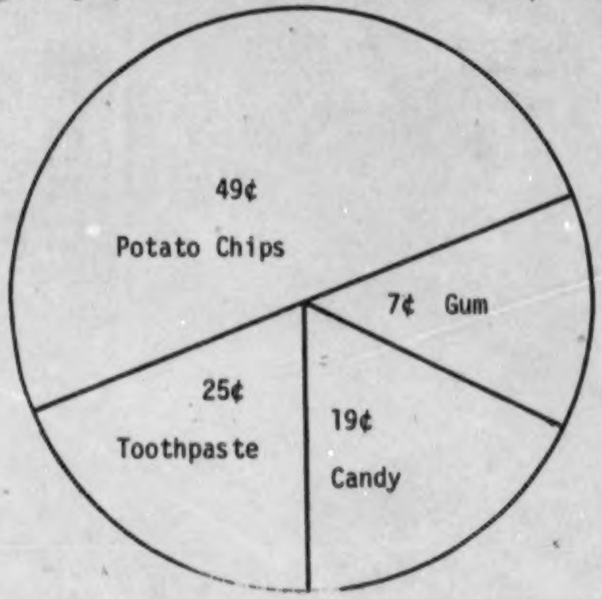
4. The weight of each starting player on a high school football team is given in the table.

   a) Compute the average weight of the starting lineup.
   b) What is the median weight of the starting lineup?
   c) What is the average weight of the starting linemen (all the players except the backs)?
   d) What is the average weight of the backfield players?

Position	Weight (lb)
Center	165
R Guard	176
L Guard	172
R Tackle	200
L Tackle	180
R End	165
L End	167
Fullback	169
R Halfback	168
L Halfback	140
Quarterback	159

CIRCLE GRAPH

A circle graph is used to show the different parts that make us a whole. Look at the circle graph below that shows how Sue spent $1.00 at the store:



1. a) What part of the $1.00 did Sue spend on candy? ____________

   b) How much did she spend on gum and candy? __________

   c) On what did she spend the most money? _________

2. Make a circle graph to show how you would spend $2.00 at the store.

PROBABILITY - Suggested Activities

Answer Sheet

101. Results will vary.

102. Results will vary.

103. blue (Probability of drawing blue marble = 6/10.)

104. Results will vary.

105. a. P (3 heads) = 1/8
    b. P (2 heads and 1 tail) = 3/8
    c. P (1 head and 2 tails) = 3/8
    d. P (3 tails) = 1/8

106. Possible outcomes: 1, 2, 3, 4, 5, or 6

107. P (staying well) = 4/6 He will probably stay well.

108. Results will vary.

109.

110. a) P (tails) = 1/2
    b) Yes
    c) Answers will vary. Fractions equivalent to 1/2.

111. P (picking matched pair) = 2/4

112. a) P (even number) = 6/11
    b) P (odd number) = 5/11
    c) P (even & multiple of 5) = 0
    d) P (odd and multiple of 5) = 2/11

113. a) P (blue chip on 1st draw) = 4/12
    b) P (white chip on 1st draw) = 3/12
    c) P (not getting white on 1st draw) = 9/12
    d) P (red on 2nd draw after red on 1st draw) = 4/11
    e) There are no blue chips.

114. P (heads) = 1/2. No change in probability.

115. Results will vary.

116. P (getting an "A" card) = 14/36
    P (getting an "E" card) = 2/36
    "C" and "D" cards have equal chances.

    Results will vary.

117. P (landing on 6) = 1/6
P (landing on 3) = 1/6
Results will vary.

118. Project will vary.

119. A is most likely to win because P (throwing 9) = 4/36, while P (throwing 11) is only 2/36.

120. Results will vary.

121. Results will vary.

122. Results will vary.

123. Results will vary.

124. Results will vary.

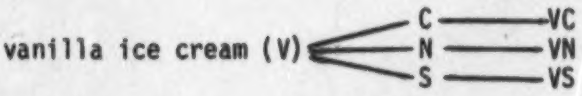
125. 1 red, 1 yellow, or 1 red, 1 green, or 1 blue, 1 yellow, or 1 blue, 1 green (4 possible outcomes)

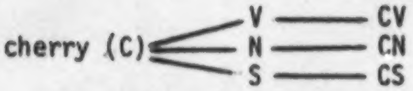
GRAPHING - Suggested Activities

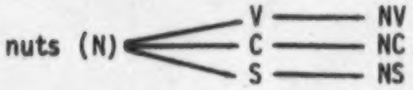
Answer Sheet

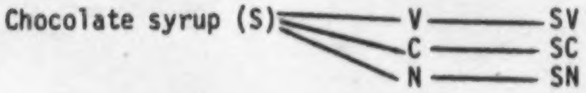
401. - 412. Results and graphs will vary.

413.


vanilla ice cream (V)
C
N
S
VC
VN
VS


cherry (C)
V
N
S
CV
CN
CS


nuts (N)
V
C
S
NV
NC
NS


Chocolate syrup (S)
V
C
N
SV
SC
SN

(Note: Two of the same ingredient have not been combined.)

414. - 415. Results and graphs will vary.

PROBABILITY

Answer Sheet

201. 1 = yes, yes, yes
2 = results will vary
3 = results will vary

202. Results will vary

203. Results will vary

204. 1. 2 possible outcomes
2. 4 possible outcomes
3. 5 possible outcomes
4. 7/30
5. 6
6. 6/30
7. 3
8. 3/30
9. 9
10. 9/30

205a. 1. answers will vary
2. table and results will vary
205b. 3. graphs will vary
205c. 4. results will varly
5. 6 possible outcomes
6. answers will vary
7. answers will vary
8. answers will vary

206. 1. HTT, THH, THT, TTH, TTT
2. 8 possible outcomes
3. 1/8
4. 1/8
5. 1 out of 8 times or 1/8 of the time
6. 1 out of 8 times or 1/8 of the time

207. 1. Results and tables will vary.
2. Results will vary.
3. Results will vary.

208a. 1. 4
2. 1/2
3. 10 times
4. 1/4

208b. 5. 5 times
6. 1/8
7. 4 times
8. 1/4
5 outcomes
1/9

208c. 9. 4 outcomes 16 times
8 outcomes 1/8 8 times
1/16 4 times
10. No, these are predictions or expected number of times.

209a. 1. 10 times
2. 14/60
3. 9/60
4. 10
5. 12
6. 6
7. 9/60
8. 60
9. 60/60

210. 1. 4 cards
2. 4 kings
3. 10/10
4. 1
5. 0/10
6. 0
7. King
8. Queen

211a. 1. Tables and results will vary.
2. Tables and results will vary.
3. 2 different outcomes: H, T
211b. 4. Answer will vary.
5. No
6. 12 times
7. 12, 11, 50
8. 12/20, 11/15; 50/100

Sums: $\frac{20}{20} = 1$, $\frac{15}{15} = 1$, $\frac{100}{100} = 1$

9. 1

211c. 10. Results and tables will vary.
11. Answers will vary
12. 2/4 or 1/2
13. 1/4

212. 1. Certain
2. equal chances
3. uncertain
4. certain
5. impossible
6. certain/equal chances
7. uncertain
8. uncertain
9. likely
10. uncertain

213a. Table 1: does not get a hit, T, HT or TH, does not take off
"Failures" take all outcomes that are not success.

208c. 9. 4 outcomes 16 times
8 outcomes 1/8 8 times
1/16 4 times
10. No, these are predictions or expected number of times.

209a. 1. 10 times
2. 14/60
3. 9/60
4. 10
5. 12
6. 6
7. 9/60
8. 60
9. 60/60

210. 1. 4 cards 5. 0/10
2. 4 kings 6. 0
3. 10/10 7. King
4. 1 8. Queen

211a. 1. Tables and results will vary.
2. Tables and results will vary.
3. 2 different outcomes: H, T
211b. 4. Answer will vary.
5. No
6. 12 times
7. 12, 11, 50
8. 12/20, 11/15; 50/100

Sums: $\frac{20}{20} = 1, \quad \frac{15}{15} = 1, \quad \frac{100}{100} = 1$

9. 1

211c. 10. Results and tables will vary.
11. Answers will vary
12. 2/4 or 1/2
13. 1/4

212. 1. Certain
2. equal chances
3. uncertain
4. certain
5. impossible
6. certain/equal chances
7. uncertain
8. uncertain
9. likely
10. uncertain

213a. Table 1: does not get a hit, T, HT or TH, does not take off
"Failures" take all outcomes that are not success.

213b.		$\frac{1}{2}$	T	$\frac{1}{2}$	$\frac{2}{2} = 1$
			HT, TT	$\frac{1}{2}$	$\frac{2}{2} = 1$
		$\frac{1}{2}$	does not get a hit	$\frac{1}{2}$	$\frac{2}{2} = 1$
	takes off	$\frac{1}{2}$	does not take off	$\frac{1}{2}$	$\frac{2}{2} = 1$

1. 1
2. yes
3. 5/6
4. 60%
5. 1 out of 4

GRAPHING

Answer Sheet

301. 1. Bears
2. 17 years
3. Mouse
4. 3 years

302. Results and graphs will vary.

303. Results and graphs will vary.

304a. 1.a) Saturday
b) answer will vary (graph compares)

2.a) Friday
b) answers will vary (chart shows exact temperatures, graph might be less exact to read)

3.a) Tuesday
b) 54°

4.a) Sunday
b) answers will vary (graph more pictorial - compare lengths of bars)

304b. 5.a) 5 days
6. Tuesday, Wednesday

7. 92° - 54° = 38° difference

8. 54° to 92°

305a. 1.

Jan.	6"	July	5"
Feb.	5.3"	Aug.	6"
Mar.	4.7"	Sept.	1.9"
Apr.	2.9"	Oct.	3.4"
May	2.1"	Nov.	6.1"
June	1.5"	Dec.	7"

2. a) June, July, August, September
b) January, February, November, December

3. No

4. No, it shows you the average of all the days of the month.

305b. 5. a) 88°, 3:00PM
b) 66°, 2AM, 5AM, and 6AM
c) 18° increase
d) 14° drop

6,7. Graph as illustrated by example. Note title and labels on both axes.

306a. 1. a) Lengths of the four longest river systems.
b) Yes

2. a) 250 miles
b) longer

3. It allows you to compare by sight. May be other answers discussed.

4. Easier comparison. May be other answers discussed.

5. a)

Mississippi - Missouri	4,750 miles
Nile	4,000 miles
Amazon	4,200 miles
Ob	3,200 miles

b) As accurate as we can estimate between squares
(1 square = 250 miles)
Not accurate to nearest mile.
Can be accurate to nearest 100 miles.

6. a) Would not be as accurate, but depends upon what nearest figure we choose.

b) No, nearest 1000 miles not precise enough.

306b. 7. a)

1900	15,000,000
1910	18,000,000
1920	21,000,000
1930	24,000,000
1940	22,000,000
1950	21,500,000
1960	18,000,000

b) 3,000,000

c) 1900-1910, 1910-1920, 1920-1930
3 million increase

d) 1930-1960

8. & 9. Graph as illustrated by example shown.

10. Estimates must be greater than 180,000,000 as noted by trend of graph.

307a. 1.
94
92
91
91
91
90
89
88
87
87
86
86
85
85
84
84
79
77
76
64

range: 64-94
mean: 85.3
median: 86.5
mode: 91

2. a) Three game totals: 412, 442, 498, 476, 572
b) Team totals: Game 1 776
Game 2 809
Game 3 815

c) 137, 147, 166, 159, 191
d) 800

307b.
96
94
92
92
90
89
88
87
85
85
84
83
82
82
81
80
78
77
75
74
72
72
69
66

a) range: 66-96
b) median: 82.5
c) mean: 82.2

307c. 4. a) 169 lbs.
b) 168 lbs.
c) 175 lbs.
d) 159 lbs.'

308. 1. a) $\frac{19}{100}$ or 19%

b) 19¢ + 7¢ = 26¢

c) potato chips

2. Graphs will vary. Be sure parts are proportional.